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Industrial automation systems and integration – Integration of life-cycle data for oil and gas production facilities – Part 2: Data model

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ABSTRACT:

KEYWORDS:

Industrial data, oil and gas, facility, life-cycle, integration, overview, data model

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Comments to reader:

This is a first draft of ISO 15926-1 for review by members of WG3 T21 "Oil and gas". Reviewers are requested to bring their initial comments to the meeting of WG3 T21 to be held in Orlando FL, USA on 1998-02-03. An additional comments should be sent to the Project Leader no later than 1998-02-18. A revised working draft will be issued before the ISO TC184/SC4 & WGs meeting in Bad Aibling, Germany (6/98).

Interim editorial guidelines, and an accompanying Word template, have been used in the preparation of this document. These guidelines apply the requirements of the ISO/IEC Directives 3, and appropriate requirements of the SC4 Supplementary Directives for ISO 10303. Editorial notes and issues within the text are indicated through the use of boxed text.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 15926-2 was prepared by Technical Committee ISO/TC184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 15926 consists of the following parts under the general title *Industrial automation systems and integration – Integration of life-cycle data for oil and gas production facilities*:

— Part 1, Overview and fundamental principles;

— Part 2, Data model;

— Part 3, Methodology for the development and maintenance of reference data libraries.

The structure of this International Standard is described in ISO 15926-1.

Annex A forms an normative part of this part of ISO 15926. Annexes B and C are for information only.

Introduction

ISO 15926 is an International Standard for the representation of oil and gas production facility life-cycle information. This representation is specified by a generic, conceptual data model that is suitable as the basis for implementation in a shared database or data warehouse. The data model is designed to be used in conjunction with reference data - instances of the generic data model that are associated with particular application semantics.

ISO 15926 is organized as a number of parts, each published separately. This part of ISO 15926 gives the specification of the data model. The following are included in this part:

— a statement of the scope of the entity types of the model;

— a statement of the EXPRESS language facilities that are not used in this part of ISO 15926;

— the specification of a conceptual data model that supports the representation of information about all aspects of an oil and gas production facility throughout its life-cycle, documented using ISO 10303 Part 11 EXPRESS language;

— a visualisation of the data model using ISO 10303 EXPRESS G formatted diagrams;

— an informative description of the data modelling principles applied to the construction of the model;

— informative examples of use of the model to record oil and gas production facility information.

Industrial automation systems and integration – Integration of life-cycle data for oil and gas production facilities – Part 2: Data model

1 Scope

This part of ISO 15926 specifies a conceptual data model that represents information such that any useful programmable application of oil and gas facility information can be supported by computerised databases that satisfy the data model specification.

The data model covers the subject entity types:

— physical object

— functional object

— activity

— characteristic

— information content

— person

— complex object

the qualifier entity types:

— class, specific and typical

— actual, planned, predicted and required

— real

and the association entity types:

— composition, collection and assembly

— classification and specialisation

— assignment and involvement

— description and identification

— possession of characteristic

— derivation

— fulfilment

— version

— authorisation and control

— basis for class membership

— normal association

The data model does not describe or specify any particular application viewpoint of oil and gas facility information.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 15926-1:1998, *Industrial automation systems and integration – Integration of life-cycle data for oil and gas production facilities - Part 1 Overview and fundamental principles.*

ISO 10303-11:1994, *Industrial automation systems and integration – Product data representation and exchange – Part 11: The EXPRESS language reference manual.*

3 Terms and definitions

For the purposes of this part of ISO 15926, the terms given in ISO 15926-1 and the following apply.

data: a representation of information in a formal manner suitable for communication, interpretation, or processing by human beings or computers.

information: facts, concepts, or instructions.

4 Use of ISO 10303 Part 11 EXPRESS

The data model is specified using the ISO 10303 Part 11 Express information modelling language. Not all the features of this language are used by ISO 15926.

The following EXPRESS constructs are excluded from the specification of the data model:

– constructed data types;

– generalised data types;

– parameter data types;

- List, array and bag aggregate types;
- aggregates of simple types;
- subtyping rules of AND and ANDOR;
- derived attributes;
- attribute redeclaration (attribute specialisation);
- domain rules (where clause);
- uniqueness rules;
- global rules;
- algorithms;
- constants.

Entity type and attribute names are restricted to be less than or equal to forty characters.

5 Instance identifiers

Instances within a compliant database or exchange file implementation shall have an artificial unique internal identifier, this being the system defined surrogate for the entity the instance represents.

The internal identifier is omitted from the data model specification because it is only known and valid within the scope of the system defining it.

This may be better placed in a compliance section of the standard. In scope of Part 1 ?

6 Data model specification

6.1 Introduction

Yet to be written. How are introductions Normative ?

6.2 Concepts and assumptions

Yet to be written. Could repeat or refer to EPISTLE. How can this be normative ?

6.3 Oil and gas production facilities schema

The following EXPRESS declaration begins the oil and gas production facilities schema. There are no external references.

```
*)
SCHEMA oil_and_gas_production_facilities;

(* Derived from the POSC/CAESAR Snapshot E specification of 98 01 07.
```

6.4 Type definitions

The data model named types are defined as follows.

6.4.1 ndt_boolean

A named type that is a BOOLEAN simple type.

EXPRESS specification:

```
*)
TYPE ndt_boolean = BOOLEAN;
END_TYPE;
(*
```

6.4.2 ndt_int4

A named type that is an INTEGER simple type.

EXPRESS specification:

```
*)
TYPE ndt_int4 = INTEGER;
END_TYPE;
(*
```

6.4.3 ndt_lifecycle

A named ENUMERATED type that is an enumeration of actual, planned, required and predicted.

EXPRESS specification:

```
*)
TYPE ndt_lifecycle = ENUMERATION OF(actual,planned,required,predicted);
END_TYPE;
(*
```

6.4.4 ndt_logical

A named type that is a LOGICAL simple type.

EXPRESS specification:

```
*)
TYPE ndt_logical = LOGICAL;
END_TYPE;
(*
```

6.4.5 ndt_real8

A named type that is a REAL simple type.

EXPRESS specification:

```
*)
TYPE ndt_real8 = REAL;
END_TYPE;
(*
```

6.4.6 ndt_short_name

A named type that is a STRING simple type, used for short names.

EXPRESS specification:

```
*)
TYPE ndt_short_name = STRING;
```

```
END_TYPE;
(*
```

6.4.7 ndt_text

A named type that is a STRING simple type.

EXPRESS specification:

```
*)
TYPE ndt_text = STRING;
END_TYPE;
```

Entity type definitions

The data model entity types are presented in alphabetical order by name.

6.5.1 act_class_from_act_derivation

An association indicating an activity class, the product, is derived from a specific or typical activity, the basis.

EXPRESS specification:

```
*)
ENTITY act_class_from_act_derivation
  SUBTYPE OF(derivation);
  product                    :  activity_class;
  basis                      :  activity;
END_ENTITY;
(*
```

Attribute definitions:

product	The activity class that results from the derivation.
basis	The activity acting as the basis for the activity class derivation.

6.5.2 activity

A type of instance object that is something happening that changes the perceived state of the universe. Supertype of specific and typical activity.

EXPRESS specification:

```
*)
ENTITY activity
  ABSTRACT SUPERTYPE OF (ONEOF(specific_activity, typical_activity))
  SUBTYPE OF(instance_object);
INVERSE
  classification_member      :  SET OF activity_classification FOR mem-
                               ber;
  derivation_product         :  SET OF activity_derivation FOR product;
  derivation_basis           :  SET OF activity_derivation FOR basis;
  authorisation_purpose      :  SET OF authorisation FOR pur-
                               pose_activity;
  created_association        :  SET OF association FOR start;
  terminated_association     :  SET OF association FOR stop;
  involvement_involver       :  SET OF involvement FOR involver;
  class_derivation_basis     :  SET OF act_class_from_act_derivation
                               FOR basis;
  pob_protection_prevented   :  SET OF specific_physical_obj_protection
```

```
                                    FOR prevented_activity;
   fac_protection_prevented         :  SET OF specific_facility_protection FOR
                                    prevented_activity;
END_ENTITY;
(*
```

Attribute definitions:

classification_member	The activity classifications this activity is involved with as the member.
derivation_product	The activity derivations this activity is involved with as the product.
derivation_basis	The activity derivations this activity is involved with as the basis.
authorisation_purpose	The authorisation association this activity is involved with as the purpose.
created_association	The associations that become effective as a result of this activity.
terminated_association	The associations that are terminated by this activity.
involvement_involver	The involvement associations this activity is associated with as the involver.
class_derivation_basis	The activity class from activity derivations this activity is involved with as the basis.
pob_protection_prevented	The specific physical object protection association this activity is involved with as the prevented.
fac_protection_prevented	The specific facility protection association this activity is involved in as the prevented.

6.5.3 activity_class

A type of class object that is a category of activities.

EXPRESS specification:

```
*)
ENTITY activity_class
   SUBTYPE OF(class_object);
INVERSE
   classification_class         :  SET OF activity_classification FOR
                                class;
   specialisation_subclass      :  SET OF activity_class_specialisation
                                FOR subclass;
   specialisation_superclass    :  SET OF activity_class_specialisation
                                FOR superclass;
   normal_characterised         :  SET OF normal_activity_char FOR charac-
                                terised;
   authorisation_purpose        :  SET OF authorisation FOR purpose_class;
   normal_involver              :  SET OF normal_involvement FOR involver;
   cha_basis_characterised      :  SET OF cha_basis_for_act_class_membersh
                                FOR characterised;
   normal_part                  :  SET OF normal_activity_composition FOR
                                part;
   normal_whole                 :  SET OF normal_activity_composition FOR
                                whole;
   normal_successor             :  SET OF normal_activity_sequence FOR
                                successor;
   normal_predecessor           :  SET OF normal_activity_sequence FOR
                                predecessor;
```

```
    pob_protection_prevented     :  SET OF specific_physical_obj_protection
                                 FOR prevented_class;
    class_derivation_product     :  SET OF act_class_from_act_derivation
                                 FOR product;
    cha_cl_basis_characterised   :  SET OF cha_cl_basis_for_act_cl_member
                                 FOR characterised;
    composition_basis_part       :  SET OF comp_basis_for_act_cl_membership
                                 FOR part;
    composition_basis_whole      :  SET OF comp_basis_for_act_cl_membership
                                 FOR whole;
    derivation_basis             :  SET OF activity_class_derivation FOR
                                 basis;
    derivation_product           :  SET OF activity_class_derivation FOR
                                 product;
    fac_protection_prevented     :  SET OF specific_facility_protection FOR
                                 prevented_class;
    product_method               :  SET OF product_basis_for_pob_cl_member
                                 FOR method;
    certification_method         :  SET OF certification_bas_for_pob_cl_mem
                                 FOR method;
    involved_basis_involver      :  SET OF involved_basis_for_act_class_mem
                                 FOR involver;
END_ENTITY;
(*
```

Attribute definitions:

classification_class	The activity classifications this class is involved with as the class.
specialisation_subclass	The activity class specialisation associations this class is involved with as the subclass.
specialisation_superclass	The activity class specialisation associations this class is involved with as the superclass.
normal_characterised	The normal activity characteristic associations this activity class is involved with as the characterised.
authorisation_purpose	The authorisation associations this activity class is involved with as the purpose.
normal_involver	The normal involvement associations this activity class is associated with as the involver.
cha_basis_characterised	The characteristic basis for activity class membership associations this activity class is involved with as the characterised.
normal_part	The normal activity composition associations this activity class is involved with as the part.
normal_whole	The normal activity composition associations this activity class is involved with as the whole.
normal_successor	The normal activity sequence associations this activity class is involved with as the successor.
normal_predecessor	The normal activity sequence associations this activity class is involved with as the predecessor.
pob_protection_prevented	The specific physical object protection associations this activity class is involved with as the prevented.
class_derivation_product	The activity class from activity derivation associations this activity class is involved with as the product.
cha_cl_basis_characterised	The characteristic class basis for activity class membership associations this activity class is involved with as the characterised.

composition_basis_part	The composition basis for activity class membership associations this activity class is involved with as the part.
composition_basis_whole	The composition basis for activity class membership associations this activity class is involved with as the whole.
derivation_basis	The activity class derivations this activity class is involved with as the basis.
derivation_product	The activity class derivation associations this activity class is involved with as the product.
fac_protection_prevented	The specific facility protection associations this activity class is involved with as the prevented.
product_method	The product basis for physical object class membership associations this activity class is involved with as the method.
certification_method	The certification basis for physical object class membership associations this activity class is involved with as the method.
involved_basis_involver	The involved basis for activity class membership associations this activity class is involved with as the involver.

6.5.4 activity_class_derivation

A type of derivation association indicating an activity class, the basis, is basis for another activity class, the product.

EXPRESS specification:

```
*)
ENTITY activity_class_derivation
   SUBTYPE OF(derivation);
   product                      :  activity_class;
   basis                        :  activity_class;
END_ENTITY;
(*
```

Attribute definitions:

product	The activity class acting as the product in the activity class derivation.
basis	The activity class acting as the basis in the activity class derivation.

6.5.5 activity_class_specialisation

A type of specialisation association indicating that one activity class, the subclass, is a specialisation of another activity class, the superclass.

EXPRESS specification:

```
*)
ENTITY activity_class_specialisation
   SUBTYPE OF(specialisation);
   superclass                   :  activity_class;
   subclass                     :  activity_class;
END_ENTITY;
(*
```

Attribute definitions:

superclass	The activity class acting as the superclass in the activity class specialisation association.
subclass	The activity class acting as the subclass in the activity class specialisation association.

6.5.6 activity_classification

A type of classification association indicating that an activity, the member, is a member of the activity class.

EXPRESS specification:

```
*)
ENTITY activity_classification
  SUBTYPE OF(classification);
  class                        :  activity_class;
  member                       :  activity;
END_ENTITY;
(*
```

Attribute definitions:

class	The activity class that is classifying the member class.
member	The activity that is classified to be a member of the class

6.5.7 activity_derivation

A type of derivation association indicating that an activity, the product, has been based on the design and form of another activity, the basis.

EXPRESS specification:

```
*)
ENTITY activity_derivation
  SUBTYPE OF(derivation);
  product                      :  activity;
  basis                        :  activity;
END_ENTITY;
(*
```

Attribute definitions:

product	The activity that results from the derivation.
basis	The activity acting as the basis for the derivation of another activity,the product.

6.5.8 assignment

An association indicating that a thing, the player, is assigned to a role, defined as a functional object.

EXPRESS specification:

```
*)
ENTITY assignment
  SUPERTYPE OF (ONEOF(assignment_of_information, assign-
                              ment_of_person_to_org, employment, spe-
                              cific_installation, typical_installation))
  SUBTYPE OF(association);
  role                         :  functional_object;
  player                       :  thing;
INVERSE
  classification_member        :  SET OF assignment_classification FOR
                              member;
END_ENTITY;
(*
```

Attribute definitions:

role	The functional object acting as role in the assignment associa-

	tion.
player	The thing acting as the player in the assignment association.
classification_member	The assignment classification associations this assignment is involved in as member.

6.5.9 assignment_class

An association indicating a category of assignments. The assignment class relates a functional object (role) with a class object (player). Only assignments that relates a member of the class object as the player to the role given by the functional object may be a member of the assignment class.

EXPRESS specification:

```
*)
ENTITY assignment_class
  SUBTYPE OF(association);
  role                          :  functional_object;
  player                        :  class_object;
INVERSE
  classification_class          :  SET OF assignment_classification FOR
                                class;
END_ENTITY;
(*
```

Attribute definitions:

role	The functional object acting as role in the assignment class association.
player	The class object acting as player in the assignment class association.
classification_class	The assignment classification associations this assignment class is involved in as the class.

6.5.10 assignment_classification

A type of classification association indicating that an assignment, the member, is classified by an assignment class.

EXPRESS specification:

```
*)
ENTITY assignment_classification
  SUBTYPE OF(classification);
  class                         :  assignment_class;
  member                        :  assignment;
END_ENTITY;
(*
```

Attribute definitions:

class	The assignment class acting as class in the assignment classification association.
member	The assignment acting as member in the assignment classification association.

6.5.11 assignment_of_information

A type of assignment association indicating that a characteristic or possession of a characteristic is assigned to a signal, stating what information the signal is sending. Note that this charcateristic is not the physical phenomenum that might be used to signify the information of the signal.

EXPRESS specification:

```
 *)
 ENTITY assignment_of_information
   SUBTYPE OF(assignment);
 END_ENTITY;
```

(*

6.5.12 assignment_of_person_to_org

A type of assignment association indicating that a person is assigned to an organisation. Note that the organisation often describes the role of the person, e.g. an instance of organisation could be "data modelling function".

EXPRESS specification:

```
 *)
 ENTITY assignment_of_person_to_org
   SUBTYPE OF(assignment);
 END_ENTITY;
```

(*

6.5.13 association

An association defines an involvement of two or more objects i.e. what one thing has to do with another. Each object involved with the association plays a role in that association. The involvement may be actual, planned, required or predicted and may be for a determined period of time given by the creation and termination dates. Associations describe statii that are interesting, and are often brought about by an activity. For example; the state of storage is brought about by the activity of transfer.

EXPRESS specification:

```
 *)
 ENTITY association
   ABSTRACT SUPERTYPE OF (ONEOF(derivation, control, composition, classi-
                                fication, normal_association,
                                spec_info_content_holding_by_pob, physi-
                                cal_object_provision, specialisation, ba-
                                sis_for_class_membership, authorisation,
                                involvement, spe-
                                cific_physical_obj_protection, fulfilment,
                                connection, us-
                                age_of_spec_pob_in_connection, version,
                                specific_phys_obj_transformation, trans-
                                portation,
                                spec_info_content_holding_by_fac,
                                flow_transmission, flow_carriage, us-
                                age_of_spec_fac_in_connection, storage,
                                specific_facility_protection, representa-
                                tion_class, codefication, representation,
                                characteristic_possession,
                                spec_characteristic_comparison, assign-
                                ment, assignment_class, production, us-
                                age_of_typ_pob_in_connection, qualifica-
                                tion_of_class, context_for_identification,
```

```
                                description, sequence, inclusion,
                                unit_of_measure_conversion, us-
                                age_of_typ_fac_in_connection))
   SUBTYPE OF(thing);
   start                        :  OPTIONAL activity;
   stop                         :  OPTIONAL activity;
 END_ENTITY;
 (*
```

Attribute definitions:

start	The activity that results in the start of this association.
stop	The activity that results in the termination of this association.

6.5.14 authorisation

An association indicating that something is authorised by a person or organisation, the authority, for a specific activity, a typical activity or activity class, the purpose. For example: the design drawings (information content) of a required facility may be approved for release for comment.

EXPRESS specification:

```
 *)
 ENTITY authorisation
   SUBTYPE OF(association);
   authorisable                 :  thing;
   authority_person             :  OPTIONAL specific_person;
   authority_organisation       :  OPTIONAL specific_organisation;
   purpose_class                :  OPTIONAL activity_class;
   purpose_activity             :  OPTIONAL activity;
 END_ENTITY;
 (*
```

Attribute definitions:

authorisable	The thing that is authorised by the authorisation.
authority_person	The person who gave the authorisation.
authority_organisation	The organisation who gave the authorisation.
purpose_class	The activity class defining the purpose of the authorisation.
purpose_activity	The activity defining the purpose of the authorisation.

6.5.15 basis_for_class_membership

An association that indicates the references a class member must have. For example: composition basis for class membership defines that a member of the part class must be a part of a member of the whole class. Basis for class membership are currently assumed to be additive when referencing the same class i.e. they all apply. Basis for class membership associations are inherited via class specialisation associations. So, all the basis of membership associations of a superclass apply to all members of all its subclasses.

EXPRESS specification:

```
 *)
 ENTITY basis_for_class_membership
   ABSTRACT SUPERTYPE OF (ONEOF(comp_basis_for_fob_class_member,
                                cha_basis_for_fob_class_membersh,
                                cha_basis_for_act_class_membersh,
                                cha_cl_basis_for_act_cl_member,
                                comp_basis_for_act_cl_membership, prod-
                                uct_basis_for_pob_cl_member, certifica-
                                tion_bas_for_pob_cl_mem, in-
```

```
                                volved_basis_for_act_class_mem,
                                cha_cl_basis_for_pob_cl_membersh,
                                cha_cl_basis_for_fob_cl_membersh,
                                cha_basis_for_cha_cl_membership,
                                comp_basis_for_cha_class_member,
                                cha_basis_for_pob_cl_membership,
                                role_basis_for_class_membership,
                                comp_basis_for_pob_class_member, typifica-
                                tion_basis_pob_cl_member,
                                info_basis_for_class_member))
   SUBTYPE OF(association);
END_ENTITY;
```

(*

6.5.16 binary_object

A type of information content that is a binary representation of information.

EXPRESS specification:

```
*)
ENTITY binary_object
   SUBTYPE OF(specific_information_content);
   binary_value                 :  BINARY;
END_ENTITY;
(*
```

Attribute definitions:

binary_value	A binary representation of information.

6.5.17 boolean_info_content

A type of specific information content that is a representation of true or false.

EXPRESS specification:

```
*)
ENTITY boolean_info_content
   SUBTYPE OF(specific_information_content);
   boolean_value                :  ndt_boolean;
END_ENTITY;
(*
```

Attribute definitions:

boolean_value	A representation of a boolean value (true or false).

6.5.18 certification_bas_for_pob_cl_mem

An association indicating an activity class that is part of the basis for membership of the physical object class. To be member of the physical object class, the member must be certified by a member of the activity class.

EXPRESS specification:

```
*)
ENTITY certification_bas_for_pob_cl_mem
   SUBTYPE OF(basis_for_class_membership);
   certified                    :  physical_object_class;
   method                       :  activity_class;
```

```
END_ENTITY;
(*
```

Attribute definitions:

certified	The physical object class acting as certified in the certification basis for physical object class membership assoication.
method	The activity class acting as the method in the certification basis for physical object class membership association.

6.5.19 cha_basis_for_act_class_membersh

A type of basis for class membership association indicating possession of a characteristic is part of the basis for membership of an activity class.

EXPRESS specification:

```
*)
ENTITY cha_basis_for_act_class_membersh
  SUBTYPE OF(basis_for_class_membership);
  characterised                :  activity_class;
  characteristic               :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The activity class whose members are required to have the characteristic.
characteristic	The specific characteristic members of the activity class are required to have.

6.5.20 cha_basis_for_cha_cl_membership

A type of basis for class membership association indicating possession of a specific characteristic is part of the basis for membership of the characteristic class.

EXPRESS specification:

```
*)
ENTITY cha_basis_for_cha_cl_membership
  SUBTYPE OF(basis_for_class_membership);
  characterised                :  characteristic_class;
  characteristic               :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The characteristic class with a characteristic basis for class membership.
characteristic	The specific characteristic defining class membership.

6.5.21 cha_basis_for_fob_class_membersh

A type of basis for class membership association indicating that possession of a characteristic is part of the basis for membership of a functional object class.

EXPRESS specification:

```
*)
ENTITY cha_basis_for_fob_class_membersh
  SUBTYPE OF(basis_for_class_membership);
  characterised                :  functional_object_class;
```

```
   characteristic               :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The functional object class whose members are required to have the characteristic.
characteristic	The characteristic the members of the characterised functional object class are required to have.

6.5.22 cha_basis_for_pob_cl_membership

A type of basis for class membership association indicating possession of a characteristic is part of the basis for membership of the physical object class.

EXPRESS specification:

```
*)
ENTITY cha_basis_for_pob_cl_membership
   SUBTYPE OF(basis_for_class_membership);
   characterised                :  physical_object_class;
   characteristic               :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The physical object class whose members are required to have the characteristic.
characteristic	The characteristic the members of the characterised physical object class are required to have.

6.5.23 cha_cl_basis_for_act_cl_member

A type of basis for class membership association indicating members of an activity class must possess characteristics that are member of the characteristic class.

EXPRESS specification:

```
*)
ENTITY cha_cl_basis_for_act_cl_member
   SUBTYPE OF(basis_for_class_membership);
   characterised                :  activity_class;
   characteristic               :  characteristic_class;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The activity class whose members are required to possess characteristics of the characteristic class.
characteristic	The class of characteristic the activity class members are required to possess.

6.5.24 cha_cl_basis_for_fob_cl_membersh

A type of basis for class membership association indicating possesion of a member of a characteristic class is part of the basis for membership of the functional object class. To be a member of the functional object class, the member must have a characteristic that is member of the characteristic class.

EXPRESS specification:

```
*)
ENTITY cha_cl_basis_for_fob_cl_membersh
   SUBTYPE OF(basis_for_class_membership);
   characterised                :  functional_object_class;
   characteristic               :  characteristic_class;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The functional object class whose members are required to possess characteristics of the characteristic class.
characteristic	The class of characteristic the functional object class members are required to possess.

6.5.25 cha_cl_basis_for_pob_cl_membersh

A type of basis for class membership association indicating possession of a member of a characteristic class is part of the basis for membership of the physical object class. To be member of the physical object class, the member must have a characteristic that is member of the characteristic class.

EXPRESS specification:

```
*)
ENTITY cha_cl_basis_for_pob_cl_membersh
   SUBTYPE OF(basis_for_class_membership);
   characterised                :  physical_object_class;
   characteristic               :  characteristic_class;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The physical object class whose members are required to possess characteristics of the characteristic class.
characteristic	The class of characteristic the physical object class members are required to possess.

6.5.26 cha_class_specialisation

A type of specialisation association indicating that one characteristic class, the subclass, is a specialisation of another characteristic class, the superclass.

EXPRESS specification:

```
*)
ENTITY cha_class_specialisation
   SUBTYPE OF(specialisation);
   superclass                   :  characteristic_class;
   subclass                     :  characteristic_class;
END_ENTITY;
(*
```

Attribute definitions:

superclass	The characteristic class acting as the superclass in the characteristic class specialisation association.
subclass	The characteristic class acting as the subclass in the characteristic class specialisation association.

6.5.27 characteristic

A type of instance object that is an observable quality. A characteristic may be measurable such as a temperature, mass, shape, or colour, or may be a status such as open, closed, connected.

EXPRESS specification:

```
*)
ENTITY characteristic
  ABSTRACT SUPERTYPE OF (ONEOF(specific_characteristic, typi-
                               cal_characteristic))
  SUBTYPE OF(instance_object);
INVERSE
  classification_member        :  SET OF characteristic_classification
                               FOR member;
  possession_characteristic    :  SET OF characteristic_possession FOR
                               characteristic;
  derivation_basis             :  SET OF characteristic_derivation FOR
                               basis;
  derivation_product           :  SET OF characteristic_derivation FOR
                               product;
  representation_representee   :  SET OF representation FOR representee;
  representation_represented   :  SET OF representation FOR represented;
END_ENTITY;
(*
```

Attribute definitions:

classification_member	The characteristic classification associations this characteristic is involved with as the member.
possession_characteristic	The characteristic possession associations this characteristic is involved with as characteristic.
derivation_basis	The characteristic derivation associations this characteristic is involved with as the basis.
derivation_product	The characteristic derivation associations this characteristic is involved with as the product.
representation_representee	The representation associations this characteristic is involved with as the representee.
representation_represented	The representation associations this characteristic is involved with as represented.

6.5.28 characteristic_class

A type of class object that is a category of observables. Examples of characteristic classes are mass, temperature, age, external shape, location, rectangular coordinate, coordinate system, spherical surface, orientation, units system.

EXPRESS specification:

```
*)
ENTITY characteristic_class
  SUBTYPE OF(class_object);
INVERSE
  classification_class         :  SET OF characteristic_classification
                               FOR class;
  specialisation_subclass      :  SET OF cha_class_specialisation FOR
                               subclass;
  specialisation_superclass    :  SET OF cha_class_specialisation FOR su-
                               perclass;
  normal_pob_characteristic    :  SET OF normal_phys_obj_characteristic
```

```
                                FOR characteristic;
   normal_act_characteristic    :  SET OF normal_activity_char FOR charac-
                                teristic;
   normal_fob_characteristic    :  SET OF normal_func_obj_characteristic
                                FOR characteristic;
   pob_cl_basis_characteristic  :  SET OF cha_cl_basis_for_pob_cl_membersh
                                FOR characteristic;
   act_cl_basis_characteristic  :  SET OF cha_cl_basis_for_act_cl_member
                                FOR characteristic;
   normal_part                  :  SET OF normal_char_composition FOR
                                part;
   normal_whole                 :  SET OF normal_char_composition FOR
                                whole;
   fob_cl_basis_characteristic  :  SET OF cha_cl_basis_for_fob_cl_membersh
                                FOR characteristic;
   cha_basis_characterised      :  SET OF cha_basis_for_cha_cl_membership
                                FOR characterised;
   composition_basis_part       :  SET OF comp_basis_for_cha_class_member
                                FOR part;
   composition_basis_whole      :  SET OF comp_basis_for_cha_class_member
                                FOR whole;
   representation_class_representee :     SET OF representation_class FOR
                                representee;
   representation_class_represented :     SET OF representation_class FOR
                                represented;
END_ENTITY;
(*
```

Attribute definitions:

classification_class	The characteristic classification associations this class is involved with as the class.
specialisation_subclass	The characteristic class specialisation associations this class is involved with as the subclass.
specialisation_superclass	The characteristic class specialisation associations this class is involved with as the superclass.
normal_pob_characteristic	The normal physical object characteristic associations this characteristic class is involved with as the characteristic.
normal_act_characteristic	The normal activity characteristic associations this characteristic class is involved with as the characteristic.
normal_fob_characteristic	The normal functional object characteristic associations this characteristic class is involved with as the characteristic.
pob_cl_basis_characteristic	The characteristic class basis for physical object class membership this characteristic class is involved with as the characteristic.
act_cl_basis_characteristic	The characteristic class basis for activity class membership associations this characteristic class is involved with as the characteristic.
normal_part	The normal characteristic composition associations this characteristic class is involved with as the part.
normal_whole	The normal characteristic composition associations this characteristic class is involved with as the whole.
fob_cl_basis_characteristic	The characteristic class basis for functional object class membership associations this characteristic class is involved with as the characteristic.
cha_basis_characterised	The characteristic basis for characteristic class membership

	associations this characteristic class is involved with as the characterised.
composition_basis_part	The composition basis for characteristic class membership associations this characteristic class is involved with as the part.
composition_basis_whole	The composition basis for characteristic class membership associations this characteristic class is involved with as the whole.
representation_class_representee	The representation classes this characteristic class is involved with as the representee.
representation_class_represented	The representation classes this characteristic class is involved with as the represented.

6.5.29 characteristic_classification

A type of classification association indicating that a characteristic, the member, is classified by the characteristic class.

EXPRESS specification:

```
*)
ENTITY characteristic_classification
  SUBTYPE OF(classification);
  class                        :  characteristic_class;
  member                       :  characteristic;
END_ENTITY;
(*
```

Attribute definitions:

class	The characteristic class acting as the class for the classification.
member	The characteristic acting as the member of the classification.

6.5.30 characteristic_derivation

A type of derivation association that indicates that a characteristic, the product, has been derived from another characteristic, the basis. For example: a point in a coordinate system is a specific point derived from the parameterised or typical point (x,y,z).

EXPRESS specification:

```
*)
ENTITY characteristic_derivation
  SUBTYPE OF(derivation);
  product                      :  characteristic;
  basis                        :  characteristic;
END_ENTITY;
(*
```

Attribute definitions:

product	The characteristic produced by the derivation.
basis	The characteristic acting as the basis of the derivation.

6.5.31 characteristic_possession

A type of association indicating that a thing, the characterised, has a characteristic. Both objects, which includes physical objects, facilities, activities, person, organisation, characteristic, information content, complex object, and associations may have characteristics.

EXPRESS specification:

```
*)
```

```
ENTITY characteristic_possession
   SUBTYPE OF(association);
   characterised                :  thing;
   characteristic               :  characteristic;
END_ENTITY;
(*
```

Attribute definitions:

characterised	The thing which is being characterised by this characteristic possession association.
characteristic	The characteristic acting as the characteristic in the characteristic possession association.

6.5.32 class_classification

A type of classification association indicating a class object is a member of a class of class. Information the member class inherits from its class classification associations applies only to the class, not to members of the class. All classes may act as members in the class classification association, but only class of class may act as the class.

EXPRESS specification:

```
*)
ENTITY class_classification
   SUBTYPE OF(classification);
   class                        :  class_of_class;
   member                       :  class_object;
END_ENTITY;
(*
```

Attribute definitions:

class	The class of class acting as the class in the class classification association.
member	The class object acting as the member in the class classification association.

6.5.33 class_object

A type of object that is a the collection of well determined things into a single whole (class). Equivalent to the term set in mathematics. Every class has either explicitly or implicitly a means of defining exclusion and inclusion of prospective members. Because a class is not an individual but defines a grouping of individuals, the members, it is not possible to draw a class. Representatives of a class correspond to typical objects which are individual things and may be drawn.

EXPRESS specification:

```
*)
ENTITY class_object
   ABSTRACT SUPERTYPE OF (ONEOF(person_class, information_content_class,
                                physical_object_class, func-
                                tional_object_class, characteristic_class,
                                activity_class, class_of_class, com-
                                plex_object_class, inclusion_class))
   SUBTYPE OF(object);
INVERSE
   normal_described             :  SET OF normal_description FOR de-
                                scribed;
   information_basis_described  :  SET OF info_basis_for_class_member FOR
                                described;
```

```
    classification_member          :  SET OF class_classification FOR member;
    assignment_class_player        :  SET OF assignment_class FOR player;
    normal_player                  :  SET OF normal_assignment FOR player;
    qualification_qualifiable      :  SET OF qualification_of_class FOR
                                   qualifiable;
    qualification_qualifier        :  SET OF qualification_of_class FOR
                                   qualifier;
    normal_involved                :  SET OF normal_involvement FOR involved;
    role_basis_player              :  SET OF role_basis_for_class_membership
                                   FOR player;
 END_ENTITY;
 (*
```

Attribute definitions:

normal_described	The normal description associations this class object is involved with as the described.
information_basis_described	The information basis for class member associations this class is involved with as the described.
classification_member	The class classification associations this class is involved with as the member.
assignment_class_player	The assignment class associations this class object is involved with as the player.
normal_player	The normal assignment associations this class object is involved with as the player.
qualification_qualifiable	The qualification of class associations this class object is involved with as the qualifiable.
qualification_qualifier	The qualification of class associations this class object is involved with as the qualifier.
normal_involved	The normal involvement associations this class object is involved with as the involved.
role_basis_player	The role basis for class object membership associations this class object is involved with as the player.

6.5.34 class_of_class

A type of class objcet that is a category or set of classes. In the same way that specifics and typicals may be classified to be a member of a class, classes may also be classified to be members of classes of class. For example: the set of classes defined by POSC Caesar is a class of class.

EXPRESS specification:

```
 *)
 ENTITY class_of_class
   SUBTYPE OF(class_object);
 INVERSE
   classification_class           :  SET OF class_classification FOR class;
   specialisation_superclass      :  SET OF class_of_class_specialisation
                                  FOR superclass;
   specialisation_subclass        :  SET OF class_of_class_specialisation
                                  FOR subclass;
 END_ENTITY;
 (*
```

Attribute definitions:

classification_class	The class classification associations this class of class is involved with as the class.
specialisation_superclass	The class of class specialisation associations this class of class

	is involved with as the superclass.
specialisation_subclass	The class of class specialisation associations this class of class is involved with as the subclass.

6.5.35 class_of_class_specialisation

A type of soecialisation association that indicates that all members of a subclass class of class are members of the superclass class of class. The subclass classes satisfy all criteria of membership for the superclass class.

EXPRESS specification:

```
 *)
 ENTITY class_of_class_specialisation
   SUBTYPE OF(specialisation);
   superclass                    :  class_of_class;
   subclass                      :  class_of_class;
 END_ENTITY;
 (*
```

Attribute definitions:

superclass	The class of class acting as the superclass in the class of class specialisation association.
subclass	The class of class acting as the subclass in the class of class specialisation association.

6.5.36 classification

An association that indicates something is a member of the class. Both instance objects and classes may act as the member. Only class objects may act as the class. Classification is non transitive, members of a class cannot be assumed to be members of the classes the class is a member of.

EXPRESS specification:

```
 *)
 ENTITY classification
   ABSTRACT SUPERTYPE OF (ONEOF(person_classification,
                                info_content_classification, physi-
                                cal_object_classification, func-
                                tional_object_classification, characteris-
                                tic_classification, activ-
                                ity_classification, representa-
                                tion_classification, assign-
                                ment_classification, class_classification,
                                complex_object_classification, inclu-
                                sion_classification))
   SUBTYPE OF(association);
 END_ENTITY;


(*
```

6.5.37 codefication

An association indicating that a signal, the coded, is expected to be encoded and decoded following the means indicated by a representation class, the codebook.

EXPRESS specification:

```
 *)
```

```
ENTITY codefication
   SUBTYPE OF(association);
   coded                        :  signal;
   codebook                     :  representation_class;
END_ENTITY;
(*
```

Attribute definitions:

coded	The signal acting as coded in the codefication association.
codebook	The representation class acting as codebook in the codefication association.

6.5.38 comp_basis_for_act_cl_membership

A type of basis for class membership association indicating that a member of the whole activity class must have a part which is a member of another part activity class.

EXPRESS specification:

```
*)
ENTITY comp_basis_for_act_cl_membership
   SUBTYPE OF(basis_for_class_membership);
   whole                        :  activity_class;
   part                         :  activity_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The activity class acting as whole in the composition basis for activity class membership association.
part	The activity class acting as part in the composition basis for activity class membership association.

6.5.39 comp_basis_for_cha_class_member

A type of basis for class membership association indicating composition requirements for membership of a characteristic class. A member of a characteristic class, the whole, must have a part that is member of another characteristic class, the part.

EXPRESS specification:

```
*)
ENTITY comp_basis_for_cha_class_member
   SUBTYPE OF(basis_for_class_membership);
   whole                        :  characteristic_class;
   part                         :  characteristic_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The characteristic class acting as whole in the composition basis for characteristic class membership association.
part	The characteristic class acting as part in the composition basis for characteristic class membership association.

6.5.40 comp_basis_for_fob_class_member

A type of basis for class membership association indicating composition requirements for membership of a functional object class. A member of a functional object class, the whole, must have a part that is member of another functional object class, the part.

EXPRESS specification:

```
*)
ENTITY comp_basis_for_fob_class_member
   SUBTYPE OF(basis_for_class_membership);
   whole                        :  functional_object_class;
   part                         :  functional_object_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The functional object class acting as whole in the composition basis for functional object class membership association.
part	The functional object class acting as part in the composition basis for functional object class membership association.

6.5.41 comp_basis_for_pob_class_member

A type of basis for class membership association indicating composition requirements for membership of a physical object class. A member of a physical object class, the whole, must have a part that is member of another physical object class, the part.

EXPRESS specification:

```
*)
ENTITY comp_basis_for_pob_class_member
   SUBTYPE OF(basis_for_class_membership);
   whole                        :  physical_object_class;
   part                         :  physical_object_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The physical object class acting as whole in the composition basis for physical object class membership association.
part	The physical object class acting as part in the composition basis for physical object class membership association.

6.5.42 complex_object

A type of instance objcet that is collection of things of different types (i.e. of objects that may come from more than one generic entity type) that we wish to gather together for some purpose. A use of complex object may be to identify the classes, information contents, characteristics and associations which make up the STEPlib standard data. Another example would be to identify all things (objects and associations) that define a design case.

EXPRESS specification:

```
*)
ENTITY complex_object
   SUBTYPE OF(instance_object);
END_ENTITY;
```

(*

6.5.43 complex_object_class

A type of class objcet taht is a category or set of complex objects. A complex object can be a member of many complex object classes simultaneously and sequentially.

EXPRESS specification:

```
*)
ENTITY complex_object_class
  SUBTYPE OF(class_object);
INVERSE
  classification_class          :  SET OF complex_object_classification
                                FOR class;
END_ENTITY;
(*
```

Attribute definitions:

classification_class	The complex object classification associations this complex object class is involved with as the class.

6.5.44 complex_object_classification

A type of classification association indicating the member complex object is a member of the complex object class.

EXPRESS specification:

```
*)
ENTITY complex_object_classification
  SUBTYPE OF(classification);
  class                         :  complex_object_class;
  member                        :  specific_complex_object;
END_ENTITY;
(*
```

Attribute definitions:

class	The complex object class that is classifying the member.
member	The specific complex object that is being classified as the member.

6.5.45 composition

An association which indicates something is a part of a whole thing, where both the part and the whole are individuals (instance objects). Composition is transitive, parts of parts are also parts of the whole. For example, if the crankshaft is a part of a car engine and the engine is a part of a car, the crankshaft is a part of the car.

EXPRESS specification:

```
*)
ENTITY composition
  ABSTRACT SUPERTYPE OF (ONEOF(specific_person_composition,
                               spec_physical_obj_composition, spe-
                               cific_facility_composition,
                               spec_characteristic_composition, spe-
                               cific_service_composition, typi-
                               cal_physical_obj_composition,
                               spec_info_content_composition,
                               typ_characteristic_composition, spe-
                               cific_activity_composition, spe-
                               cific_signal_composition, spe-
                               cific_stream_composition, typi-
                               cal_activity_composition, typi-
                               cal_facility_composition, typi-
                               cal_info_content_composition, typi-
                               cal_service_composition, typi-
```

```
                                cal_signal_composition, typi-
                                cal_stream_composition))
   SUBTYPE OF(association);
END_ENTITY;
```

(*

6.5.46 connection

An association which indicates two things are connected. Connectedness allows the transmision or transfer of something such as force, energy, material, information. The association is symmetric and non transitive.

EXPRESS specification:

```
*)
ENTITY connection
   ABSTRACT SUPERTYPE OF (ONEOF(specific_physical_obj_connection, spe-
                                cific_facility_connection, typi-
                                cal_physical_obj_connection, typi-
                                cal_facility_connection))
   SUBTYPE OF(association);
END_ENTITY;
```

(*

6.5.47 context_for_identification

A type of association indicating that an identification has a context in which the identifier is unique. The context is a class or instance object that is the set of things which are being distinguished by this identification. All identification associations having the same context are reckoned to have different identifiers.

EXPRESS specification:

```
*)
ENTITY context_for_identification
   SUBTYPE OF(association);
   identification               :  identification;
   context_set                  :  object;
END_ENTITY;
(*
```

Attribute definitions:

identification	The identification association acting as the identification in the context for identification association.
context_set	The object acting as context set in the context for identification association.

6.5.48 control

A type of association indicating that an object, the controllable, is under the control of a person, or an organisation, acting as the controller. Control idicates custody or responsibility of an item. Authorisations may be granted by a controller that involve things within his or her control.

EXPRESS specification:

```
*)
```

```
ENTITY control
   SUBTYPE OF(association);
   controllable                  :  object;
   controller_person             :  OPTIONAL specific_person;
   controller_organisation       :  OPTIONAL specific_organisation;
END_ENTITY;
(*
```

Attribute definitions:

controllable	The object that is subject to the control of an organisation or person.
controller_person	The person that acts as the controller of the controllable.
controller_organisation	The organisation acting as the controller in the control association.

6.5.49 count

A type of information content that is a representation of a integer number.

EXPRESS specification:

```
*)
ENTITY count
   SUBTYPE OF(specific_information_content);
   count_value                   :  ndt_int4;
END_ENTITY;
(*
```

Attribute definitions:

count_value	An integer representation of the count.

6.5.50 datetime

A type of information content that is a representation of a point in time as a calendar date and a 24hr clock time within the day.

EXPRESS specification:

```
*)
ENTITY datetime
   SUBTYPE OF(specific_information_content);
   year                          :  OPTIONAL INTEGER;
   month                         :  OPTIONAL INTEGER;
   day                           :  OPTIONAL INTEGER;
   hour                          :  OPTIONAL INTEGER;
   minute                        :  OPTIONAL INTEGER;
   second                        :  OPTIONAL INTEGER;
INVERSE
   thing_creation                :  SET OF thing FOR creation;
   thing_termination             :  SET OF thing FOR termination;
END_ENTITY;
(*
```

Attribute definitions:

year	The year part of the datetime. The number of years since 0 A.D.
month	The month part of the datetime. The month number within year, less or equal to 12.
day	The day part of the datetime. The day number within month,

	less or equal to 31.
hour	The hour part of the datetime. The 24 hour number within day, less than 24.
minute	The minute part of the datetime. The minute number within hour, less than 60.
second	The second part of the datetime. The second number within minute, less than 60.
thing_creation	The instances of thing that uses this datetime as the creation date and time.
thing_termination	The instances of thing that uses this datetime as the termination date and time.

6.5.51 definition

An association indicating that a specific information content, the descriptor, is expected to be a principal source of understanding about the nature of a thing, the described.

EXPRESS specification:

```
 *)
 ENTITY definition
    SUBTYPE OF(description);
 END_ENTITY;


(*
```

6.5.52 derivation

An association which indicates the product came to be by using information about the basis. Examples of derivation are: an actual specific object (the product)is made by copying another actual specific object (the basis); an actual specific object is made by refering to a planned specific object as a source of information about the size, shape, and form. Typicals may be derived from specifics, typicals and classes, specifics from typicals or typicals, and classes from typicals. Derivation is non transitive. Derivation does not imply that the product shares any properties or behaviour of the basis. If the product does have features in common with its bases, they must be explicitly restated. Derivation is distinct from version. A version is always different from what it is a version of and implies deliberate change.

EXPRESS specification:

```
 *)
 ENTITY derivation
    ABSTRACT SUPERTYPE OF (ONEOF(fob_class_from_fob_derivation, physi-
                                 cal_object_derivation,
                                 pob_class_from_pob_derivation, activ-
                                 ity_derivation,
                                 act_class_from_act_derivation, facil-
                                 ity_derivation, activity_class_derivation,
                                 signal_derivation, characteris-
                                 tic_derivation,
                                 func_object_class_derivation, serv-
                                 ice_derivation, physi-
                                 cal_obj_class_derivation,
                                 info_content_class_derivation, informa-
                                 tion_content_derivation,
                                 stream_derivation))
    SUBTYPE OF(association);
```

```
END_ENTITY;
```

(*

6.5.53 description

An association indicating that a thing, the described, is described by an information content, the descriptor.

EXPRESS specification:

```
*)
ENTITY description
   SUPERTYPE OF (ONEOF(identification, definition))
   SUBTYPE OF(association);
   described                    :  thing;
   descriptor                   :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

described	The thing that is described by the descriptor information content.
descriptor	The information content acting as the descriptor of the description.

6.5.54 dimension

A representative characteristic that is a particular combination of base quantity dimensions such as mass, length, and time. It includes the base dimensions and the dimension one. It is used to denote the dimensionality of units of measure.

EXPRESS specification:

```
*)
ENTITY dimension
   SUBTYPE OF(typical_point);
END_ENTITY;
```

(*

6.5.55 employment

An association indicating a person is employed by an organisation.

EXPRESS specification:

```
*)
ENTITY employment
   SUBTYPE OF(assignment);
END_ENTITY;
```

(*

6.5.56 facility

A type of functional object that is a performer role of equipment or material that enable things to happen. For example: PUMP 101 on a P&ID. A facility is either a specific or a typical facility.

EXPRESS specification:

```
*)
ENTITY facility
  ABSTRACT SUPERTYPE OF (ONEOF(specific_facility, typical_facility))
  SUBTYPE OF(functional_object);
INVERSE
  derivation_basis              :  SET OF facility_derivation FOR basis;
  derivation_product            :  SET OF facility_derivation FOR product;
  holding_info_carrier          :  SET OF spec_info_content_holding_by_fac
                                FOR info_carrier;
  flow_transmission_source      :  SET OF flow_transmission_from FOR
                                source;
  flow_transmission_destination :  SET OF flow_transmission_to FOR desti-
                                nation;
  flow_carriage_carrier         :  SET OF flow_carriage FOR carrier;
END_ENTITY;
(*
```

Attribute definitions:

derivation_basis	The facility derivation associations this facility is involved with as the basis.
derivation_product	The facility derivation associations this facility is involved with as the product.
holding_info_carrier	The specific information content holding by facility associations this facility is involved with as the information carrier.
flow_transmission_source	The flow transmission from associations this facility is involved with as the source.
flow_transmission_destination	The flow transmission to associations this facility is involved with as the destination.
flow_carriage_carrier	The flow carriage associations this facility is involved with as the carrier.

6.5.57 facility_derivation

A type of derivation association indicating that a facility, the product, has been based on the design and form of another facility, the basis.

EXPRESS specification:

```
*)
ENTITY facility_derivation
  SUBTYPE OF(derivation);
  product                       :  facility;
  basis                         :  facility;
END_ENTITY;
(*
```

Attribute definitions:

product	The facility acting as the product in the facility derivation association.
basis	The facility acting as the basis in the facility derivation association.

6.5.58 flow

A type of functional object that is the role of things moving or being moved in a continuous fashion.

EXPRESS specification:

```
*)
ENTITY flow
   ABSTRACT SUPERTYPE OF (ONEOF(signal, stream))
   SUBTYPE OF(functional_object);
INVERSE
   flow_carriage_carried         :  SET OF flow_carriage FOR carried;
   flow_transmission_transmitted :  SET OF flow_transmission FOR transmit-
                                    ted;
END_ENTITY;
(*
```

Attribute definitions:

flow_carriage_carried	The flow carriage associations this flow is involved with as the carried.
flow_transmission_transmitted	The flow transmission associations this flow is involved with as the transmitted.

6.5.59 flow_carriage

A type of association indicating that a flow, the carried, is being send or transmitted using a facility, the carrier.

EXPRESS specification:

```
*)
ENTITY flow_carriage
   SUBTYPE OF(association);
   carrier                       :  facility;
   carried                       :  flow;
END_ENTITY;
(*
```

Attribute definitions:

carrier	The facility acting as carrier in the flow carriage association.
carried	The flow acting as carried in the flow carriage association.

6.5.60 flow_transmission

An association indicating that a flow is tranmitted from a source to a destination. The flow transmission is an abstract association with two subtypes, one indicating a source and one indicating a destination.

EXPRESS specification:

```
*)
ENTITY flow_transmission
   ABSTRACT SUPERTYPE OF (ONEOF(flow_transmission_from,
                                flow_transmission_to))
   SUBTYPE OF(association);
   transmitted                   :  flow;
END_ENTITY;
(*
```

Attribute definitions:

transmitted	The flow acting as transmitted in the flow transmission asso-

ciation.

6.5.61 flow_transmission_from

A type of flow transmission association indicating a source a flow is transmitted from.

EXPRESS specification:

```
 *)
 ENTITY flow_transmission_from
   SUBTYPE OF(flow_transmission);
   source                       :  facility;
 END_ENTITY;
 (*
```

Attribute definitions:

source	The facility acting as source in the flow transmission to association.

6.5.62 flow_transmission_to

A type of flow fransmission association indicating a destination a flow is transmitted to.

EXPRESS specification:

```
 *)
 ENTITY flow_transmission_to
   SUBTYPE OF(flow_transmission);
   destination                  :  facility;
 END_ENTITY;
 (*
```

Attribute definitions:

destination	The facility acting as destination in the flow transmission to association.

6.5.63 fob_class_from_fob_derivation

An association indicating that a functional object class, the product, has been based on the design and form of a specific or typical functional object. The specific or typical functional object has been found to be representative for a category of functional objects, and therefore is used as basis for defining a new functional object class.

EXPRESS specification:

```
 *)
 ENTITY fob_class_from_fob_derivation
   SUBTYPE OF(derivation);
   product                      :  functional_object_class;
   basis                        :  functional_object;
 END_ENTITY;
 (*
```

Attribute definitions:

product	The functional object class which is the product of the functional object class derivation.
basis	The functional object, specific or typical, which the functional object class is derived from.

6.5.64 fulfilment

An association which indicates that a life cycle thing, the outome, has been obtained in response to

another life cycle thing, the expected. For example: an actual specific thing is a fullilment of a planned actual thing. The meaningful combinations of the expected outcome roles are: actual with planned, predicted or required; planned with required. Fullfilment does not imply satisfaction i.e. meeting of requirements. It only means that the outcome is a result of an expectation.

EXPRESS specification:

```
 *)
 ENTITY fulfilment
   ABSTRACT SUPERTYPE OF (ONEOF(specific_physical_obj_fulfilment, spe-
                                cific_facility_fulfilment,
                                spec_characteristic_fulfilment, spe-
                                cific_service_fulfilment, typi-
                                cal_physical_obj_fulfilment, spe-
                                cific_info_content_fulfilment,
                                typ_characteristic_fulfilment, spe-
                                cific_activity_fulfilment, spe-
                                cific_signal_fulfilment, spe-
                                cific_stream_fulfilment, typi-
                                cal_activity_fulfilment, typi-
                                cal_facility_fulfilment, typi-
                                cal_info_content_fulfilment, typi-
                                cal_service_fulfilment, typi-
                                cal_signal_fulfilment, typi-
                                cal_stream_fulfilment))
   SUBTYPE OF(association);
 END_ENTITY;


(*
```

6.5.65 func_object_class_derivation

A type of derivation association indicating that a functional object class, the product, has been based on the definition of another functional object class, the basis.

EXPRESS specification:

```
 *)
 ENTITY func_object_class_derivation
   SUBTYPE OF(derivation);
   product                      :  functional_object_class;
   basis                        :  functional_object_class;
 END_ENTITY;
 (*
```

Attribute definitions:

product	The functional object class acting as the product in the functional object class derivation association.
basis	The functional object class acting as the basis in the functional object class derivation association.

6.5.66 func_object_class_specialisation

A type of specialisation association indicating that one functional object class, the subclass, is a specialisation of another functional object class, the superclass.

EXPRESS specification:

```
 *)
```

```
ENTITY func_object_class_specialisation
  SUBTYPE OF(specialisation);
  superclass                    :  functional_object_class;
  subclass                      :  functional_object_class;
END_ENTITY;
(*
```

Attribute definitions:

superclass	The functional object class acting as the superclass in the functional object class specialisation association.
subclass	The functional object class acting as the subclass in the functional object class specialisation association.

6.5.67 functional_object

A type of instance object that is a function or role and may be involved in many activities, considered independently of the physical objects that may undertake the roles from time to time. Roles may be active (making it happen) or passive (happening to). Function objects must be either Facilities, Flows or Services.

EXPRESS specification:

```
*)
ENTITY functional_object
  ABSTRACT SUPERTYPE OF (ONEOF(service, facility, flow))
  SUBTYPE OF(instance_object);
INVERSE
  class_derivation_basis        :  SET OF fob_class_from_fob_derivation
                                FOR basis;
  classification_member         :  SET OF functional_object_classification
                                FOR member;
  assignment_role               :  SET OF assignment FOR role;
  assigment_class_role          :  SET OF assignment_class FOR role;
  involved_basis_involved       :  SET OF involved_basis_for_act_class_mem
                                FOR involved;
  role_basis_role               :  SET OF role_basis_for_class_membership
                                FOR role;
END_ENTITY;
(*
```

Attribute definitions:

class_derivation_basis	The functional object class from functional object derivation associations this functional object is involved with as the basis.
classification_member	The functional object classification associations this functional object is involved with as the member.
assignment_role	The assignment associations this functional object is involved with as the role.
assigment_class_role	The assignment class associations this functional object is involved with as the role.
involved_basis_involved	The involved basis for activity class membership associations this functional object is involved with as the involved.
role_basis_role	The role basis for class object membership associations this functional object is involved with as the role.

6.5.68 functional_object_class

A type of class object that is a category or set of functional objects. A functional object can be a member of many classes, simultaneously and sequentially. Groups of functional object claases are

distinguished by class of class.

EXPRESS specification:

```
*)
ENTITY functional_object_class
  SUBTYPE OF(class_object);
INVERSE
  classification_class         :  SET OF functional_object_classification
                                  FOR class;
  normal_whole                 :  SET OF normal_func_object_composition
                                  FOR whole;
  normal_part                  :  SET OF normal_func_object_composition
                                  FOR part;
  normal_side_a                :  SET OF normal_func_object_connection
                                  FOR side_a;
  normal_side_b                :  SET OF normal_func_object_connection
                                  FOR side_b;
  specialisation_subclass      :  SET OF func_object_class_specialisation
                                  FOR subclass;
  specialisation_superclass    :  SET OF func_object_class_specialisation
                                  FOR superclass;
  composition_basis_part       :  SET OF comp_basis_for_fob_class_member
                                  FOR part;
  composition_basis_whole      :  SET OF comp_basis_for_fob_class_member
                                  FOR whole;
  cha_basis_characterised      :  SET OF cha_basis_for_fob_class_membersh
                                  FOR characterised;
  normal_characterised         :  SET OF normal_func_obj_characteristic
                                  FOR characterised;
  normal_holding_info_carrier  :  SET OF normal_icc_holding_by_facility
                                  FOR info_carrier;
  cha_cl_basis_characterised   :  SET OF cha_cl_basis_for_fob_cl_membersh
                                  FOR characterised;
  class_derivation_product     :  SET OF fob_class_from_fob_derivation
                                  FOR product;
  derivation_basis             :  SET OF func_object_class_derivation FOR
                                  basis;
  derivation_product           :  SET OF func_object_class_derivation FOR
                                  product;
  normal_role                  :  SET OF normal_assignment FOR role;
END_ENTITY;
(*
```

Attribute definitions:

classification_class	The functional object classification associations this class is involved with as the class.
normal_whole	The normal functional object composition associations this class is involved with as the whole.
normal_part	The normal functional object composition associations this class is involved with as the part.
normal_side_a	The normal functional object connection associations this functional object class is involved with as side a.
normal_side_b	The normal functional object connection associations this functional object class is involved with as side b.
specialisation_subclass	The functional object class specialisation associations this functional object class is involved with as the subclass.

specialisation_superclass	The functional object class specialisation associations this functional object class is involved with as the superclass.
composition_basis_part	The composition basis for functional object class membership associations this functional object class is involved with as the part.
composition_basis_whole	The composition basis for functional object class membership associations this functional object class is involved with as the whole.
cha_basis_characterised	The characteristic basis for functional object class membership associations this functional object class is involved with as the characterised.
normal_characterised	The normal functional object characteristic associations this functional object class is involved with as the characterised.
normal_holding_info_carrier	The normal information content class holding by facility associations this functional object class is involved with as the information carrier.
cha_cl_basis_characterised	The characteristic class basis for functional object class membership associations this functional object class is involved with as the characterised.
class_derivation_product	The functional object class from functional object derivation associations this functional object class is involved with as the product.
derivation_basis	The functional object class derivation associations this functional object class is involved with as the basis.
derivation_product	The functional object class derivation associations this functional object class is involved with as the product.
normal_role	The normal assignment associations this functional object class is involved with as the role.

6.5.69 functional_object_classification

A type of classification association classifying a functional object. The classification may be for a period of time, and a functional object may have several classifications at one time and over the life time of the functional object.

EXPRESS specification:

```
*)
ENTITY functional_object_classification
   SUBTYPE OF(classification);
   class                        :  functional_object_class;
   member                       :  functional_object;
END_ENTITY;
(*
```

Attribute definitions:

class	The functional object class acting as the class in the functional object classification association.
member	The functional object acting as the member in the functional object classification association.

6.5.70 identification

A type of description association indicating the descriptor information content is used as a means of refering to, or designating, the described. Text items such as names, labels, tags, and identification numbers are examples of identification descriptors.

EXPRESS specification:

```
*)
ENTITY identification
  SUBTYPE OF(description);
INVERSE
  identification_context        :  SET OF context_for_identification FOR
                                  identification;
END_ENTITY;
(*
```

Attribute definitions:

identification_context	The context for identification associations this identification is involved in as the identification.

6.5.71 inclusion

An association indicating a thing is included in a specific complex object. Inclusion differs from collection (subtype of composition) in that it includes things of different types (e.g. material classes, characteristic classess and normal material characteristics), whereas collection groups things of the same type only (e.g. specific materials).

EXPRESS specification:

```
*)
ENTITY inclusion
  SUBTYPE OF(association);
  included                      :  thing;
  includer                      :  specific_complex_object;
INVERSE
  classification_member         :  SET OF inclusion_classification FOR
                                  member;
END_ENTITY;
(*
```

Attribute definitions:

included	The thing acting as the included in an inclusion association.
includer	The specific complex object acting as the includer in an inclusion association.
classification_member	The inclusion classification associations this inclusion is involved with as the member.

6.5.72 inclusion_class

A type of class object that is a category or set of inclusions. For example: the set of inclusions which are agreed, or the set that are proposed.

EXPRESS specification:

```
*)
ENTITY inclusion_class
  SUBTYPE OF(class_object);
INVERSE
  classification_class          :  SET OF inclusion_classification FOR
                                  class;
END_ENTITY;
(*
```

Attribute definitions:

classification_class	The inclusion classification associations this inclusion class is

involved with as the class.

6.5.73 inclusion_classification

A type of classification association indicating an inclusion is classified as a member of an inclusion class.

EXPRESS specification:

```
*)
ENTITY inclusion_classification
  SUBTYPE OF(classification);
  class                       :  inclusion_class;
  member                      :  inclusion;
END_ENTITY;
(*
```

Attribute definitions:

class	The inclusion class acting as the class in the inclusion classification association.
member	The inclusion acting as the member in the inclusion classification association.

6.5.74 info_basis_for_class_member

A type of basis for class membership association indicating the information content that forms part of the basis for defining membership of the class, and applies to all class members.

EXPRESS specification:

```
*)
ENTITY info_basis_for_class_member
  SUBTYPE OF(basis_for_class_membership);
  described                   :  class_object;
  descriptor                  :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

described	The class object acting as the described in the information basis for class membership association.
descriptor	The specific information content acting as the descriptor in the information basis for class membership association.

6.5.75 info_content_cl_specialisation

A type of specialisation association that indicates that one class of information content, the subclass, is a specialisation of another class of information content, the superclass.

EXPRESS specification:

```
*)
ENTITY info_content_cl_specialisation
  SUBTYPE OF(specialisation);
  superclass                  :  information_content_class;
  subclass                    :  information_content_class;
END_ENTITY;
(*
```

Attribute definitions:

superclass	The information content class acting as a superclass in the in-

formation content class specialisation association.

subclass — The information content class acting as the subclass in the information content class specialisation association.

6.5.76 info_content_class_derivation

A type of derivation association indicating an information content class, the product, has been defined by refering to another information content class, the basis.

EXPRESS specification:

```
*)
ENTITY info_content_class_derivation
   SUBTYPE OF(derivation);
   product                      :  information_content_class;
   basis                        :  information_content_class;
END_ENTITY;
(*
```

Attribute definitions:

product — The information content class acting as the product in the information content class derivation association.

basis — The information content class acting as the basis in the information content class derivation association.

6.5.77 info_content_classification

A type of classification association indicating an information content, the member, is classified to be a member of the class.

EXPRESS specification:

```
*)
ENTITY info_content_classification
   SUBTYPE OF(classification);
   class                        :  information_content_class;
   member                       :  information_content;
END_ENTITY;
(*
```

Attribute definitions:

class — The information content class acting as class in the information content classification association.

member — The information content acting as the member in the information content classification association.

6.5.78 information_content

A type of instance object that is a representation of meaning or information as a discernable pattern. For example: character strings, sounds, pictures, bit strings. An information content is either specific or typical. Subtypes of information content are defined for useful internal computer representations of information.

EXPRESS specification:

```
*)
ENTITY information_content
   ABSTRACT SUPERTYPE OF (ONEOF(specific_information_content, typi-
                                cal_information_content))
   SUBTYPE OF(instance_object);
INVERSE
```

```
    derivation_product          :  SET OF information_content_derivation
                                FOR product;
    classification_member       :  SET OF info_content_classification FOR
                                member;
    derivation_basis            :  SET OF information_content_derivation
                                FOR basis;
 END_ENTITY;
 (*
```

Attribute definitions:

derivation_product	The information content derivation associations this information content is involved with as the product.
classification_member	The information content classification associations this information content is involved with as the member.
derivation_basis	The information content derivation associations this information content is involved with as the basis.

6.5.79 information_content_class

A type of class object that is a category or set of information contents. Example classes are: phonetic systems, SGML text format, ISO bit patterns for characters and numbers, hieroglyph and ideogram systems.

EXPRESS specification:

```
 *)
 ENTITY information_content_class
    SUBTYPE OF(class_object);
 INVERSE
    classification_class        :  SET OF info_content_classification FOR
                                class;
    normal_part                 :  SET OF normal_info_content_composition
                                FOR part;
    normal_whole                :  SET OF normal_info_content_composition
                                FOR whole;
    normal_holding_pob_content  :  SET OF normal_icc_holding_by_phys_obj
                                FOR content;
    normal_holding_fac_content  :  SET OF normal_icc_holding_by_facility
                                FOR content;
    normal_descriptor           :  SET OF normal_description FOR descrip-
                                tor;
    specialisation_subclass     :  SET OF info_content_cl_specialisation
                                FOR subclass;
    specialisation_superclass   :  SET OF info_content_cl_specialisation
                                FOR superclass;
    sequence_predecessor        :  SET OF normal_icc_sequence FOR prede-
                                cessor;
    sequence_successor          :  SET OF normal_icc_sequence FOR succes-
                                sor;
    derivation_basis            :  SET OF info_content_class_derivation
                                FOR basis;
    derivation_product          :  SET OF info_content_class_derivation
                                FOR product;
 END_ENTITY;
 (*
```

Attribute definitions:

classification_class	The information content classification associations this infor-

	mation content class is involved with as the class.
normal_part	The normal information content composition associations this information content class is involved with as the part.
normal_whole	The normal information content composition associations this information content class is involved with as the whole.
normal_holding_pob_content	The normal information content class holding by physical object associations this information content class is involved with as the content.
normal_holding_fac_content	The normal information content class holding by facility associations this information content class is involved with as the content.
normal_descriptor	The normal description associations this information content class is involved with as the descriptor.
specialisation_subclass	The information content class specialisation associations this class is involved with as the subclass.
specialisation_superclass	The information content class specialisation associations this class is involved with as the superclass.
sequence_predecessor	The normal information content class sequence associations this information content class is involved with as the predecessor.
sequence_successor	The normal information content class sequence associations this information content class is involved with as the successor.
derivation_basis	The information content class derivation associations this information content class is involved with as the basis.
derivation_product	The information content class derivation associations this information content class is involved with as the product.

6.5.80 information_content_derivation

A type of derivation association indicating that an information content, the product, has been based on another information content.

EXPRESS specification:

```
*)
ENTITY information_content_derivation
   SUBTYPE OF(derivation);
   product                      :  information_content;
   basis                        :  information_content;
END_ENTITY;
(*
```

Attribute definitions:

product	The information content acting as the product in the information content derivation association.
basis	The information content acting as the basis in the information content derivation association.

6.5.81 instance_object

A type of thing that is individual in nature. Any thing that has distinctive characteristics and behaviour that exceed those of its parts. Opposite of class, group, or set of things. An instance object is either a specific or a typical object.

EXPRESS specification:

```
*)
```

```
ENTITY instance_object
   ABSTRACT SUPERTYPE OF (ONEOF(information_content, specific_person,
                                physical_object, functional_object, char-
                                acteristic, activity, complex_object))
   SUBTYPE OF(object);
END_ENTITY;


(*
```

6.5.82 involved_basis_for_act_class_mem

A type of basis for class membership association indicating that a functional object, the involved, is part of the basis for membership of an activity class, the involver. To be a member of the activity class, the member must involve the functional object.

EXPRESS specification:

```
*)
ENTITY involved_basis_for_act_class_mem
   SUBTYPE OF(basis_for_class_membership);
   involver                    :  activity_class;
   involved                    :  functional_object;
END_ENTITY;
(*
```

Attribute definitions:

involver	The activity class acting as involver in the involved basis for activity class membership association.
involved	The functional object acting as involved in the involved basis for activity class membership association.

6.5.83 involvement

A type of association indicating which things are involved in which activities. To indicate the involvement of a role the thing involved must be a functional object. The functional object may be classified to define the class of role. Thing types such as physical object, class object, information content, activity can also be directly involved if no role is specified.

EXPRESS specification:

```
*)
ENTITY involvement
   SUBTYPE OF(association);
   involver                    :  activity;
   involved                    :  thing;
END_ENTITY;
(*
```

Attribute definitions:

involver	The activity acting as the involver in the involvement association.
involved	The thing acting as involved in the involvement association.

6.5.84 linear_conversion

A type of unit of measure conversion association indicating the rules for a linear conversion from one unit of measure (the basis) to another unit of measure (the result). Two parameters may be used, a multiplier and a offset. The rule is defined by the formula: result = (multiplier * basis) + offset

EXPRESS specification:

```
*)
ENTITY linear_conversion
  SUBTYPE OF(unit_of_measure_conversion);
  multiplier                  :  OPTIONAL ndt_real8;
  offset                      :  OPTIONAL ndt_real8;
END_ENTITY;
(*
```

Attribute definitions:

multiplier	The multiplier of the conversion.
offset	The offset of the conversion.

6.5.85 logarithmic_conversion

A type of unit of measure conversion association involving a logarithmic expression of the form y = a Log bx, y is the quantity in the result units, x is the quantity in the basis units, a and b are conversion factors, and c is the base of the logarithm.

EXPRESS specification:

```
*)
ENTITY logarithmic_conversion
  SUBTYPE OF(unit_of_measure_conversion);
  factor_a                    :  OPTIONAL ndt_real8;
  factor_b                    :  OPTIONAL ndt_real8;
  factor_c                    :  OPTIONAL ndt_real8;
END_ENTITY;
(*
```

Attribute definitions:

factor_a	The a factor of the logarithmic conversion.
factor_b	The b factor of the logarithmic conversion.
factor_c	The base of the conversion logarithm.

6.5.86 logical_info_content

A type of specific information content that is a representation of true, false or unknown.

EXPRESS specification:

```
*)
ENTITY logical_info_content
  SUBTYPE OF(specific_information_content);
  logical_value               :  ndt_logical;
END_ENTITY;
(*
```

Attribute definitions:

logical_value	A representation of a logical value (true, false or unknown).

6.5.87 measure_class

A type of characteristic class where the member characteristics are usually quantified by reference to standard measures. For example: length, area, volume, mass, duration, electric current, amount of substance, speed, acceleration, volume flow rate.

EXPRESS specification:

```
*)
ENTITY measure_class
```

```
   SUBTYPE OF(characteristic_class);
 INVERSE
   normal_uom_class             :  SET OF normal_char_unit_of_measure FOR
                                class;
 END_ENTITY;
 (*
```

Attribute definitions:

normal_uom_class	The normal characteristic unit of measure associations this measure class is involved with as the class.

6.5.88 normal_activity_assembly

A type of normal association that indicates the class of activity that normally acts in the role of part or whole for assembly of specific or typical activities.

EXPRESS specification:

```
 *)
 ENTITY normal_activity_assembly
   SUBTYPE OF(normal_activity_composition);
 END_ENTITY;


(*
```

6.5.89 normal_activity_char

A type of normal association that indicates the classes of characteristic that normally characterise activities of a class.

EXPRESS specification:

```
 *)
 ENTITY normal_activity_char
   SUBTYPE OF(normal_association);
   characterised                :  activity_class;
   characteristic               :  characteristic_class;
 END_ENTITY;
 (*
```

Attribute definitions:

characterised	The activity class acting as characterised in the normal activity characteristic association.
characteristic	The characteristic class acting as the characteristic in the normal activity characteristic association.

6.5.90 normal_activity_collection

A type of normal association that indicates the classes of activity that normally act in the role of part or whole for collections of typical or specific activities.

EXPRESS specification:

```
 *)
 ENTITY normal_activity_collection
   SUBTYPE OF(normal_activity_composition);
 END_ENTITY;


(*
```

6.5.91 normal_activity_composition

A type of normal association that indicates the classes of activity that normally act in the roles of part and whole in the composition of specific or typical activities. Normal activity composition must be specialised to be a normal activity assembly i.e.the parts having some structure, or a normal activity collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY normal_activity_composition
   ABSTRACT SUPERTYPE OF (ONEOF(normal_activity_assembly, nor-
                               mal_activity_collection))
   SUBTYPE OF(normal_association);
   whole                       :  activity_class;
   part                        :  activity_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The activity class acting as the whole in the normal activity composition association.
part	The activity class acting as the part in the normal activity composition association.

6.5.92 normal_activity_sequence

A type of normal association that indicates that a member of one activity class, the successor, normally follows a member of another activity class in time, the predecessor.

EXPRESS specification:

```
*)
ENTITY normal_activity_sequence
   SUBTYPE OF(normal_association);
   successor                   :  activity_class;
   predecessor                 :  activity_class;
END_ENTITY;
(*
```

Attribute definitions:

successor	The activity class acting as successor in the normal activity sequence association.
predecessor	The activity class acting as predecessor in the normal activity sequence association.

6.5.93 normal_assignment

A type of normal association indicating that a member of a class object will normally be assigned to members of a functional object class.

EXPRESS specification:

```
*)
ENTITY normal_assignment
   SUBTYPE OF(normal_association);
   role                        :  functional_object_class;
   player                      :  class_object;
END_ENTITY;
(*
```

Attribute definitions:

role	The functional object class acting as role in the normal assignment association.
player	The class object acting as the player in the normal assignment association.

6.5.94 normal_association

An association indicating the typical references of members of the class. For example: normal physical object characteristic indicates the class of characteristic typically possessed by a member of the physical object class. Normal does not restrict or enforce the references a class member must have. Members of the class may have none, some, all, all and more of the normal references. The subtypes of normal associations define different reference types for different classes.

EXPRESS specification:

```
 *)
 ENTITY normal_association
    ABSTRACT SUPERTYPE OF (ONEOF(normal_description, nor-
                                 mal_info_content_composition, nor-
                                 mal_icc_holding_by_phys_obj, nor-
                                 mal_func_object_composition, nor-
                                 mal_func_object_connection, nor-
                                 mal_phys_obj_characteristic, nor-
                                 mal_activity_char, normal_involvement,
                                 normal_activity_composition, nor-
                                 mal_activity_sequence, nor-
                                 mal_func_obj_characteristic, nor-
                                 mal_char_composition, nor-
                                 mal_icc_holding_by_facility, nor-
                                 mal_assignment, nor-
                                 mal_physical_obj_composition, nor-
                                 mal_physical_obj_connection, nor-
                                 mal_icc_sequence, nor-
                                 mal_char_unit_of_measure))
    SUBTYPE OF(association);
 END_ENTITY;


(*
```

6.5.95 normal_char_assembly

A type of normal association that indicates the characteristic classes whose members normally act in the roles of part and whole for assembly of specific or typical characteristics.

EXPRESS specification:

```
 *)
 ENTITY normal_char_assembly
    SUBTYPE OF(normal_char_composition);
 END_ENTITY;


(*
```

6.5.96 normal_char_collection

A type of normal association that indicates the characteristic classes whose members normally act in

the roles of part and whole for collections of typical or specific characteristics.

EXPRESS specification:

```
*)
ENTITY normal_char_collection
   SUBTYPE OF(normal_char_composition);
END_ENTITY;


(*
```

6.5.97 normal_char_composition

A type of normal association that indicates the characteristic classes whose members normally act in the roles of part and whole in the composition of specific or typical characteristics. Normal characteristic composition must be specialised to be a normal characteristic assembly i.e.the parts having some structure, or a normal characteristic collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY normal_char_composition
   ABSTRACT SUPERTYPE OF (ONEOF(normal_char_assembly, nor-
                                mal_char_collection))
   SUBTYPE OF(normal_association);
   whole                        :  characteristic_class;
   part                         :  characteristic_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The characteristic class acting as the whole in the normal characteristic composition association.
part	The characteristic class acting as the part in the normal characteristic composition association.

6.5.98 normal_char_unit_of_measure

A type of normal association that indicates the units of measure normally used for characteristic members of the measure class.

EXPRESS specification:

```
*)
ENTITY normal_char_unit_of_measure
   SUBTYPE OF(normal_association);
   class                        :  measure_class;
   unit                         :  unit_of_measure;
END_ENTITY;
(*
```

Attribute definitions:

class	The measure class acting as the class in the normal char unit of measure association.
unit	The unit of measure acting as the unit in the normal char unit of measure association.

6.5.99 normal_definition

A type of normal association indicating that a member of an information content class is normally expected to be a principal source of understanding about the nature of a member of a class object.

EXPRESS specification:

```
 *)
 ENTITY normal_definition
    SUBTYPE OF(normal_description);
 END_ENTITY;


(*
```

6.5.100 normal_description

A type of normal association indicating that members of the class object, the described,are normally described by members of the information content class, the descriptor.

EXPRESS specification:

```
 *)
 ENTITY normal_description
    SUPERTYPE OF (ONEOF(normal_definition, normal_identification))
    SUBTYPE OF(normal_association);
    described                    :  class_object;
    descriptor                   :  information_content_class;
 END_ENTITY;
 (*
```

Attribute definitions:

described	The class object acting as the described in the normal description association.
descriptor	The information content class acting as the descriptor in the normal description association.

6.5.101 normal_func_obj_characteristic

A type of normal association that indicates the classes of characteristics normally used to characterise a typical or specific functional object of the class.

EXPRESS specification:

```
 *)
 ENTITY normal_func_obj_characteristic
    SUBTYPE OF(normal_association);
    characterised                :  functional_object_class;
    characteristic               :  characteristic_class;
 END_ENTITY;
 (*
```

Attribute definitions:

characterised	The functional object class whose members are normally characterised by members of the characteristic characteristic class.
characteristic	The class of characteristics whose members are normally used to characterise members of the characterised functional object class.

6.5.102 normal_func_object_assembly

A type of normal association that indicates the class of functional object that normally acts in the role of part or whole for assembly of specific or typical functional objects.

EXPRESS specification:

```
 *)
 ENTITY normal_func_object_assembly
    SUBTYPE OF(normal_func_object_composition);
 END_ENTITY;


(*
```

6.5.103 normal_func_object_collection

A type of normal association that indicates the classes of functional object that normally act in the role of part or whole for collections of typical or specific functional objects.

EXPRESS specification:

```
 *)
 ENTITY normal_func_object_collection
    SUBTYPE OF(normal_func_object_composition);
 END_ENTITY;


(*
```

6.5.104 normal_func_object_composition

A type of normal association that indicates the classes of functional object that normally act in the roles of part and whole for specific or typical functional objects.

EXPRESS specification:

```
 *)
 ENTITY normal_func_object_composition
    ABSTRACT SUPERTYPE OF (ONEOF(normal_func_object_assembly, nor-
                                 mal_func_object_collection))
    SUBTYPE OF(normal_association);
    whole                        :  functional_object_class;
    part                         :  functional_object_class;
 END_ENTITY;
 (*
```

Attribute definitions:

whole	The class of functional object whose members normally act as the whole in the composition of specific or typical functional objects of this class.
part	The class of functional object whose members normally act as a part in the composition of a specific or typical functional object of this class.

6.5.105 normal_func_object_connection

A type of normal association that indicates the normal roles of functional object class members in a connection.

EXPRESS specification:

```
*)
ENTITY normal_func_object_connection
   SUBTYPE OF(normal_association);
   side_a                      :  functional_object_class;
   side_b                      :  functional_object_class;
END_ENTITY;
(*
```

Attribute definitions:

side_a	The functional object class whose members normally act as side a in a connection to members of the side_b functional object class.
side_b	The functional object class whose members normally act as side b in connections to members of the side a functional object class.

6.5.106 normal_icc_holding_by_facility

A type of normal association indicating that members of a facility class, the information carrier, normally hold this class of information content, the content.

EXPRESS specification:

```
*)
ENTITY normal_icc_holding_by_facility
   SUBTYPE OF(normal_association);
   info_carrier                :  functional_object_class;
   content                     :  information_content_class;
END_ENTITY;
(*
```

Attribute definitions:

info_carrier	The functional object class acting as the information carrier in the normal information content class holding by facility association.
content	The information content class acting as the content in the normal information content class holding by facility association.

6.5.107 normal_icc_holding_by_phys_obj

A type of normal association indicating that members of a physical object class, the information carrier, normally hold members of the class of information content, the content.

EXPRESS specification:

```
*)
ENTITY normal_icc_holding_by_phys_obj
   SUBTYPE OF(normal_association);
   info_carrier                :  physical_object_class;
   content                     :  information_content_class;
END_ENTITY;
(*
```

Attribute definitions:

info_carrier	The physical object class acting as the information carrier in the normal information content class holding by physical object association.
content	The information content class acting as the content in the nor-

mal information content class holding by physical object association.

6.5.108 normal_icc_sequence

A type of normal association indicating that a member of one information content class, the successor, normally follows a member of another information content class, the predecessor.

EXPRESS specification:

```
*)
ENTITY normal_icc_sequence
   SUBTYPE OF(normal_association);
   successor                    :  information_content_class;
   predecessor                  :  information_content_class;
END_ENTITY;
(*
```

Attribute definitions:

successor	The information content class whose members, specific or typical, normally are the successor in a sequence of information contents.
predecessor	The information content class whose members normally are the predecessor in an information content sequence.

6.5.109 normal_identification

A type of normal description association indicating the information content class members that normally act in the role of identification for the class objects.

EXPRESS specification:

```
*)
ENTITY normal_identification
   SUBTYPE OF(normal_description);
END_ENTITY;


(*
```

6.5.110 normal_info_content_assembly

A type of normal association that indicates the information content classes whose members normally act in the roles and part and whole for assembly of specific or typical information contents.

EXPRESS specification:

```
*)
ENTITY normal_info_content_assembly
   SUBTYPE OF(normal_info_content_composition);
END_ENTITY;


(*
```

6.5.111 normal_info_content_collection

A type of normal association that indicates the information content classes whose members normally act in the roles of part and whole for collections of typical or specific information contents.

EXPRESS specification:

```
*)
ENTITY normal_info_content_collection
   SUBTYPE OF(normal_info_content_composition);
END_ENTITY;


(*
```

6.5.112 normal_info_content_composition

A type of normal association that indicates the information content classes whose members normally act in the roles of part and whole in the composition of specific or typical information content. Normal information content composition must be specialised to be a normal information content assembly i.e. the parts having some structure, or a normal information content collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY normal_info_content_composition
   ABSTRACT SUPERTYPE OF (ONEOF(normal_info_content_assembly, nor-
                                mal_info_content_collection))
   SUBTYPE OF(normal_association);
   whole                        :  information_content_class;
   part                         :  information_content_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The class of information content whose members normally act as the whole in compositions with members of the part information content class.
part	The information content classes whose members normally act as the part in compositions with members of the whole information content class.

6.5.113 normal_involvement

A type of normal association indicating that members of a class object are normally involved with a member of an activity class.

EXPRESS specification:

```
*)
ENTITY normal_involvement
   SUBTYPE OF(normal_association);
   involver                     :  activity_class;
   involved                     :  class_object;
END_ENTITY;
(*
```

Attribute definitions:

involver	The activity class acting as involver in the normal involvement association.
involved	The class object acting as involved in the normal involvement association.

6.5.114 normal_phys_obj_characteristic

A type of normal association that indicates the classes of characteristics whose members are normally used to characterise members of a physical object class.

EXPRESS specification:

```
 *)
 ENTITY normal_phys_obj_characteristic
    SUBTYPE OF(normal_association);
    characterised                :  physical_object_class;
    characteristic               :  characteristic_class;
 END_ENTITY;
 (*
```

Attribute definitions:

characterised	The physical object class whose members are normally characterised by members of the characteristic characteristic class.
characteristic	The characteristic class whose members are normally characterising members of the characterised physical object class.

6.5.115 normal_physical_obj_assembly

A type of normal association that indicates the classes of physical objects whose members normally act as part and whole in the assembly of specific or typical physical objects.

EXPRESS specification:

```
 *)
 ENTITY normal_physical_obj_assembly
    SUBTYPE OF(normal_physical_obj_composition);
 END_ENTITY;


(*
```

6.5.116 normal_physical_obj_collection

A type of normal association that indicates the classes of physical objects whose members normally act in the roles of part and whole in the collection of specific or typical physical objects.

EXPRESS specification:

```
 *)
 ENTITY normal_physical_obj_collection
    SUBTYPE OF(normal_physical_obj_composition);
 END_ENTITY;


(*
```

6.5.117 normal_physical_obj_composition

A type of normal association that indicates the classes of physical objects whose members normally act in the roles of part and whole for the composition of specific or typical physical objects.

EXPRESS specification:

```
 *)
 ENTITY normal_physical_obj_composition
    ABSTRACT SUPERTYPE OF (ONEOF(normal_physical_obj_assembly, nor-
                                 mal_physical_obj_collection))
```

```
   SUBTYPE OF(normal_association);
   whole                        :  physical_object_class;
   part                         :  physical_object_class;
END_ENTITY;
(*
```

Attribute definitions:

whole	The class of physical objects whose members normally act as the whole in composition with members of the part physical object class.
part	The class of physical objects whose members normally act as the part in composition with members of the whole physical object class.

6.5.118 normal_physical_obj_connection

A type of normal association that indicates the classes of physical objects whose members normally act as side a in connections with side b specific and typical physical objects.

EXPRESS specification:

```
*)
ENTITY normal_physical_obj_connection
   SUBTYPE OF(normal_association);
   side_a                       :  physical_object_class;
   side_b                       :  physical_object_class;
END_ENTITY;
(*
```

Attribute definitions:

side_a	The class of physical object whose members normally act as side a in connections with members of the sibe b physical object class.
side_b	The class of physical object whose members normally act as side b in connections with members of the sibe a physical object class.

6.5.119 object

A type of thing that has independent existence. Not a relationship or a group of relationships. Objects may be involved with other objects by associations. An object may be something physical, consisting of matter, energy and space, or a concept or an idea we use to describe and understand the world we live in. Objects must be either instance objects or class objects.

EXPRESS specification:

```
*)
ENTITY object
   ABSTRACT SUPERTYPE OF (ONEOF(instance_object, class_object))
   SUBTYPE OF(thing);
INVERSE
   control_controllable         :  SET OF control FOR controllable;
   context_identification       :  SET OF context_for_identification FOR
                                context_set;
END_ENTITY;
(*
```

Attribute definitions:

control_controllable	The control associations this object is involved with as the

	controllable.
context_identification	The context for identification associations this object is involved with as the context set.

6.5.120 person_class

A type of class object that is a category or set of people. Examples of class of person are: rich people, poor people, big people, small people, Australian people....

EXPRESS specification:

```
*)
ENTITY person_class
  SUBTYPE OF(class_object);
INVERSE
  class                        :  SET OF person_classification FOR class;
END_ENTITY;
(*
```

Attribute definitions:

class	The person classifications the class is involved with as the class.

6.5.121 person_classification

A type of classification association indicating that a person, the member, is a member of a class of person.

EXPRESS specification:

```
*)
ENTITY person_classification
  SUBTYPE OF(classification);
  class                        :  person_class;
  member                       :  specific_person;
END_ENTITY;
(*
```

Attribute definitions:

class	The person class that classifies the member.
member	The person that is classified as a member of the class.

6.5.122 phys_object_class_specialisation

A type of specialisation association indicating that one class of physical object, the subclass, is a specialisation of another class of physical object, the superclass.

EXPRESS specification:

```
*)
ENTITY phys_object_class_specialisation
  SUBTYPE OF(specialisation);
  superclass                   :  physical_object_class;
  subclass                     :  physical_object_class;
END_ENTITY;
(*
```

Attribute definitions:

superclass	The physical object class acting as the superclass in the physical object class specialisation association.
subclass	The physical object class acting as the subclass in the physical

object class specialisation association.

6.5.123 physical_obj_class_derivation

A type of derivation association indicating that a physical object class, the product, has been based on the definition of another physical object class, the basis.

EXPRESS specification:

```
*)
ENTITY physical_obj_class_derivation
  SUBTYPE OF(derivation);
  product                      :  physical_object_class;
  basis                        :  physical_object_class;
END_ENTITY;
(*
```

Attribute definitions:

product	The physical object class that is the product of the derivation.
basis	The physical object class acting as the basis of the derivation.

6.5.124 physical_object

A type of instance object that obeys the laws of physics. This includes material, energy and space. A physical object is either a specific or a typical physical object.

EXPRESS specification:

```
*)
ENTITY physical_object
  ABSTRACT SUPERTYPE OF (ONEOF(specific_physical_object, typi-
                               cal_physical_object))
  SUBTYPE OF(instance_object);
INVERSE
  classification_member        :  SET OF physical_object_classification
                               FOR member;
  derivation_product           :  SET OF physical_object_derivation FOR
                               basis;
  derivation_basis             :  SET OF physical_object_derivation FOR
                               product;
  holding_info_carrier         :  SET OF spec_info_content_holding_by_pob
                               FOR info_carrier;
  class_derivation_basis       :  SET OF pob_class_from_pob_derivation
                               FOR basis;
  physical_object_provision_suppliable  :     SET OF physi-
                               cal_object_provision FOR suppliable;
  production_product           :  SET OF production FOR product;
END_ENTITY;
(*
```

Attribute definitions:

classification_member	The physical object classifications this physical object is involved with as member.
derivation_product	The physical object derivations this physical object is involved with as the product.
derivation_basis	The physical object derivations this physical object is involved with as the basis.
holding_info_carrier	The specific information content holding by physical object associations this physical object is involved with as the informa-

	tion carrier.
class_derivation_basis	The physical object class from physical object derivation associations this physical object, specific or typical, is involved in as the basis.
physical_object_provision_suppliable	The physical object provision association this physical object, typical or specific, is involved in as the suppliable.
production_product	The production association this physical object is involved with as the product.

6.5.125 physical_object_class

A type of class object that is a category or set of physical objects. For example. apple, engine, heat, magnetic field. A physical object can be a member of many physical object classes simultaneously and sequentially.

EXPRESS specification:

```
*)
ENTITY physical_object_class
  SUBTYPE OF(class_object);
INVERSE
  classification_class          :  SET OF physical_object_classification
                                FOR class;
  specialisation_subclass       :  SET OF phys_object_class_specialisation
                                FOR subclass;
  specialisation_superclass     :  SET OF phys_object_class_specialisation
                                FOR superclass;
  normal_whole                  :  SET OF normal_physical_obj_composition
                                FOR whole;
  normal_part                   :  SET OF normal_physical_obj_composition
                                FOR part;
  composition_basis_whole       :  SET OF comp_basis_for_pob_class_member
                                FOR whole;
  composition_basis_part        :  SET OF comp_basis_for_pob_class_member
                                FOR part;
  normal_side_a                 :  SET OF normal_physical_obj_connection
                                FOR side_a;
  normal_side_b                 :  SET OF normal_physical_obj_connection
                                FOR side_b;
  normal_characterised          :  SET OF normal_phys_obj_characteristic
                                FOR characterised;
  cha_basis_characterised       :  SET OF cha_basis_for_pob_cl_membership
                                FOR characterised;
  normal_holding_info_carrier   :  SET OF normal_icc_holding_by_phys_obj
                                FOR info_carrier;
  class_derivation_product      :  SET OF pob_class_from_pob_derivation
                                FOR product;
  cha_cl_basis_characterised    :  SET OF cha_cl_basis_for_pob_cl_membersh
                                FOR characterised;
  derivation_basis              :  SET OF physical_obj_class_derivation
                                FOR basis;
  derivation_product            :  SET OF physical_obj_class_derivation
                                FOR product;
  product_produced              :  SET OF product_basis_for_pob_cl_member
                                FOR produced;
  certification_certified       :  SET OF certification_bas_for_pob_cl_mem
                                FOR certified;
  typification_basis_typified   :  SET OF typification_basis_pob_cl_member
```

```
                                    FOR typified;
END_ENTITY;
(*
```

Attribute definitions:

classification_class	The physical object classifications this class is involved with as the class.
specialisation_subclass	The physical object class specialisation associations this class is involved with as the subclass.
specialisation_superclass	The physical object class specialisation associations this class is involved with as the superclass.
normal_whole	The normal compositions this class is involved with as the whole.
normal_part	The normal compositions this class is involved with as the part.
composition_basis_whole	The composition basis for physical object class membership this class is involved with as the whole.
composition_basis_part	The composition basis for physical object class membership this physical object class is involved with as the part.
normal_side_a	The normal physical object connections this class is involved with as side a.
normal_side_b	The normal physical object class connections this class is involved with as side b.
normal_characterised	The normal physical object class characteristics this physical object class is involved with as the characterised.
cha_basis_characterised	The characteristic basis for physical object class membership this physical object class is involved in as the characterised.
normal_holding_info_carrier	The normal information content class holding by physical object associations this physical object class is involved with as the information carrier.
class_derivation_product	The physical object class from physical object derivation association this class is involved with as the product.
cha_cl_basis_characterised	The characteristic class basis for physical object class membership this physical object class is involved in as the characterised.
derivation_basis	The physical object class derivation this physical object class is involved with as the basis.
derivation_product	The physical object class derivation this physical object class is involved with as the product.
product_produced	The product basis for physical object class membership associations this physical object class is involved in as the produced.
certification_certified	The certification basis for physical object class membership associations this physical object class is involved in as the certified.
typification_basis_typified	The typification basis for physical object class membership associations this physical object class is involved with as the typified.

6.5.126 physical_object_classification

A type of classification association indicating the member physical object is a member of a physical object class.

EXPRESS specification:

```
*)
```

```
ENTITY physical_object_classification
  SUBTYPE OF(classification);
  class                        :  physical_object_class;
  member                       :  physical_object;
END_ENTITY;
(*
```

Attribute definitions:

class	The physical object class that is classifying the member physical object.
member	The physical object that is classified as class.

6.5.127 physical_object_derivation

A type of derivation association indicating that a physical object, the product, has been based on the design and form of another physical object, the basis. Copying of a document to give document copies is an example of the concept of physical object derivation, each copy being a different physical object.

EXPRESS specification:

```
*)
ENTITY physical_object_derivation
  SUBTYPE OF(derivation);
  product                      :  physical_object;
  basis                        :  physical_object;
END_ENTITY;
(*
```

Attribute definitions:

product	The physical object produced by the derivation.
basis	The physical object acting as the basis of the derivation.

6.5.128 physical_object_provision

A type of association association indicating that a physical object is supplied by an organisation.

EXPRESS specification:

```
*)
ENTITY physical_object_provision
  SUBTYPE OF(association);
  supplier                     :  specific_organisation;
  suppliable                   :  physical_object;
END_ENTITY;
(*
```

Attribute definitions:

supplier	The specific organisation acting as the supplier in the physical object provision association.
suppliable	The physical object, typical or specific, acting as the suppliable in the physical object provision association.

6.5.129 pob_class_from_pob_derivation

An association indicating that a physical object class, the product, has been based on the design and form of a specific or typical physical object. The specific or typical physical object has been found to be representative for a category of physical objects, and therefore is used as basis for defining a new physical object class.

EXPRESS specification:

```
*)
ENTITY pob_class_from_pob_derivation
   SUBTYPE OF(derivation);
   product                      :  physical_object_class;
   basis                        :  physical_object;
END_ENTITY;
(*
```

Attribute definitions:

product	The physical object class which is the product of the physical object class derivation.
basis	The physical object, specific or typical, which the physical object class is derived from.

6.5.130 product_basis_for_pob_cl_member

A type of basis for class membership association indicating an activity class that is part of the basis for membership of the physical object class. To be member of the physical object class, the member must be produced by a member of the activity class.

EXPRESS specification:

```
*)
ENTITY product_basis_for_pob_cl_member
   SUBTYPE OF(basis_for_class_membership);
   produced                     :  physical_object_class;
   method                       :  activity_class;
END_ENTITY;
(*
```

Attribute definitions:

produced	The physical object class acting as the produced in the product basis for physical object class membership association.
method	The activity class acting as the method in the product basis for physical object class membership association.

6.5.131 production

A type of association indicating that a physical object is produced or manufactured by an organisation.

EXPRESS specification:

```
*)
ENTITY production
   SUBTYPE OF(association);
   product                      :  physical_object;
   producer                     :  specific_organisation;
END_ENTITY;
(*
```

Attribute definitions:

product	The physical object acting as the product in the production association.
producer	The specific organisation acting as the producer in the production association.

6.5.132 qualification_of_class

A type of association indicating that a member of the qualifier class object can used to specialise the qualifiable class object. The types of the associations intended to be used to define the additional subclasses are not indicated.

EXPRESS specification:

```
*)
ENTITY qualification_of_class
   SUBTYPE OF(association);
   qualifiable                  :  class_object;
   qualifier                    :  class_object;
END_ENTITY;
(*
```

Attribute definitions:

qualifiable	The class object acting as qualifiable in the qualification of class association.
qualifier	The class object acting as qualifier in the qualification of class association.

6.5.133 quantity_info_content

An type of specific information content that is a representation of a quantity as a real number and a unit of measure.

EXPRESS specification:

```
*)
ENTITY quantity_info_content
   SUBTYPE OF(specific_information_content);
   quantity_value               :  ndt_real8;
   unit_of_measure              :  unit_of_measure;
END_ENTITY;
(*
```

Attribute definitions:

quantity_value	The number of units of the quantity measure.
unit_of_measure	The units of measure used to enumerate the amount.

6.5.134 representation

A type of association indicating that one characteristic, the representee, represents another characteristic, the represented. The represented will most often be a state something is or may be in. The representee is the phenomen that represents that state. An example is an electric current (representee) being used to signify a liquid level (represented) in a tank.

EXPRESS specification:

```
*)
ENTITY representation
   SUBTYPE OF(association);
   representee                  :  characteristic;
   represented                  :  characteristic;
INVERSE
   classification_member        :  SET OF representation_classification
                                FOR member;
END_ENTITY;
(*
```

Attribute definitions:

representee	The characteristic acting as representee in the representation association.
represented	The characteristic acting as represented in the representation association.
classification_member	The representation classification associations this representation is involved in as member.

6.5.135 representation_class

A type of class object that is a category of representations. The representation class relates two characteristic classes, where one is a class of states (represented) and the other is a class of phenomenon (representee). Only representations that relates a member of the represented, and a member of the representee may be a member of the representation class.

EXPRESS specification:

```
*)
ENTITY representation_class
  SUBTYPE OF(association);
  representee                 :  characteristic_class;
  represented                 :  characteristic_class;
INVERSE
  codefication_codebook       :  SET OF codefication FOR codebook;
  classification_class        :  SET OF representation_classification
                              FOR class;
END_ENTITY;
(*
```

Attribute definitions:

representee	The characteristic class acting as representee in the representation class.
represented	The characteristic class acting as represented in the representation class.
codefication_codebook	The codefication associations this representation class is involved as the codebook.
classification_class	The representation classification associations this representation class is involved in as class.

6.5.136 representation_classification

A type of classification association indicating that a representation, the member, is classified by a representation class.

EXPRESS specification:

```
*)
ENTITY representation_classification
  SUBTYPE OF(classification);
  class                       :  representation_class;
  member                      :  representation;
END_ENTITY;
(*
```

Attribute definitions:

class	The representation class acting as class in the representation classification association.
member	The representation acting as member in the representation classification association.

6.5.137 role_basis_for_class_membership

A type of basis for class membership association indicating that a functional object, the role, is part of the basis for membership of a class object, the player. To be a member of the class object, the member must be able to play the role of the functional object.

EXPRESS specification:

```
*)
ENTITY role_basis_for_class_membership
  SUBTYPE OF(basis_for_class_membership);
  role                          :  functional_object;
  player                        :  class_object;
END_ENTITY;
(*
```

Attribute definitions:

role	The functional object acting as role in the role basis for class object membership association.
player	The class object acting as player in the role basis for class object membership association.

6.5.138 sequence

A type of association indicating one thing, the successor, follows another, the predecesor, in time. The association is transitive and non symetric.

EXPRESS specification:

```
*)
ENTITY sequence
  ABSTRACT SUPERTYPE OF (ONEOF(specific_info_content_sequence, spe-
                               cific_activity_sequence, typi-
                               cal_activity_sequence, typi-
                               cal_info_content_sequence))
  SUBTYPE OF(association);
END_ENTITY;


(*
```

6.5.139 service

A type of functional objcet that is the roles carried out directly or indirectly, by people. Covers such things as plummer, engineer and electrician, manufacturer, supplier, contractor, manager. Organisation is a subtype of service that is an assembly of roles played by people.

EXPRESS specification:

```
*)
ENTITY service
  ABSTRACT SUPERTYPE OF (ONEOF(specific_service, typical_service))
  SUBTYPE OF(functional_object);
INVERSE
  derivation_product            :  SET OF service_derivation FOR product;
  derivation_basis              :  SET OF service_derivation FOR basis;
END_ENTITY;
(*
```

Attribute definitions:

derivation_product	The service derivation associations this service is involved in as the product.
derivation_basis	The service derivation associations this service is involved in as the basis.

6.5.140 service_derivation

A type of derivation association indicating that a service, the product, has been based on the design and form of another service, the basis.

EXPRESS specification:

```
*)
ENTITY service_derivation
  SUBTYPE OF(derivation);
  product                    :  service;
  basis                      :  service;
END_ENTITY;
(*
```

Attribute definitions:

product	The service, specific or typical, acting as the product in the service derivation association.
basis	The service, specific or typical, acting as the basis in the service derivation association.

6.5.141 signal

A type of flow that is a flow of information, where information can be the state something is in, an instruction, command or permission.

EXPRESS specification:

```
*)
ENTITY signal
  ABSTRACT SUPERTYPE OF (ONEOF(specific_signal, typical_signal))
  SUBTYPE OF(flow);
INVERSE
  derivation_product         :  SET OF signal_derivation FOR product;
  derivation_basis           :  SET OF signal_derivation FOR basis;
  codefication_coded         :  SET OF codefication FOR coded;
END_ENTITY;
(*
```

Attribute definitions:

derivation_product	The signal derivation associations this signal is involved in as the product.
derivation_basis	The signal derivation associations this signal is involved in as the basis.
codefication_coded	The codefication associations this signal is involved in as the coded.

6.5.142 signal_derivation

A type of derivation association indicating that a signal, the product, has been based on the design and form of another signal, the basis.

EXPRESS specification:

```
*)
ENTITY signal_derivation
```

```
   SUBTYPE OF(derivation);
   product                      :  signal;
   basis                        :  signal;
END_ENTITY;
(*
```

Attribute definitions:

product	The signal acting as the product in the signal derivation association.
basis	The signal acting as basis in the signal derivation association.

6.5.143 spec_characteristic_assembly

A type of composition association indicating that a specific characteristic is a part of another characteristic, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY spec_characteristic_assembly
   SUBTYPE OF(spec_characteristic_composition);
END_ENTITY;


(*
```

6.5.144 spec_characteristic_collection

A type of composition association indicating that a specific characteristic is part of a collection of specific characteristics, the whole. Collection implies there is no structure or intended relationships between the parts of the collection.

EXPRESS specification:

```
*)
ENTITY spec_characteristic_collection
   SUBTYPE OF(spec_characteristic_composition);
END_ENTITY;


(*
```

6.5.145 spec_characteristic_comparison

A type of association indicating that one specific characteristic, the compared, is defined in relation to the compared_to specific characteristic. Characteristics of a comparison may be defined through a characteristic_possession association. The characteristic of the comparison then expresses how the compared is defined with relation to the compared_to, e.g. the compared is 10degC greater than the compared_to .

EXPRESS specification:

```
*)
ENTITY spec_characteristic_comparison
   SUBTYPE OF(association);
   compared_to                  :  specific_characteristic;
   compared                     :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

compared_to	The specific characteristic acting as the characteristic that is compared to another specific characteristic.
compared	The specific characteristic acting as the compared in the comparison.

6.5.146 spec_characteristic_composition

A type of composition association indicating that a characteristic is part of another characteristic, the whole. Composition must be specialised to be a collection, where the parts have no implied structure, or to be an assembly which implies structure between the parts and the whole.

EXPRESS specification:

```
*)
ENTITY spec_characteristic_composition
   ABSTRACT SUPERTYPE OF (ONEOF(spec_characteristic_assembly,
                                spec_characteristic_collection))
   SUBTYPE OF(composition);
   whole                        :  specific_characteristic;
   part                         :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

whole	The specific characteristic acting as the whole for the composition.
part	The specific characteristic that is the part for the composition.

6.5.147 spec_characteristic_fulfilment

A type of fulfilment association between specific characteristics at different life cycle states indicating that one specific characteristic (the outcome) fulfils the intent (expectation) implicit in the other specific characteristic. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY spec_characteristic_fulfilment
   SUBTYPE OF(fulfilment);
   outcome                      :  specific_characteristic;
   expectation                  :  specific_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The specific characteristic acting as the outcome characteristic in the fulfilment association.
expectation	The specific characteristic acting as the expected characteristic in the fulfilment association.

6.5.148 spec_info_content_assembly

A type of composition association indicating that a specific information content is a part of another specific information content, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
```

```
ENTITY spec_info_content_assembly
  SUBTYPE OF(spec_info_content_composition);
END_ENTITY;
```

(*

6.5.149 spec_info_content_collection

A type of composition association indicating that a specific information content, the part, is a part of collection of specific information contents, the whole. Collection implies there is no structure or intended relationships between the parts of the collection. A specific information content may be part of many collections sequentially and simultaneously.

EXPRESS specification:

```
*)
ENTITY spec_info_content_collection
  SUBTYPE OF(spec_info_content_composition);
END_ENTITY;
```

(*

6.5.150 spec_info_content_composition

A type of composition association indicating a specific information content, the part, is a part of another specific information content, the whole. Composition must be specialised to be a collection, where the parts have no implied structure, or to be an assembly which implies structure between the parts and the whole.

EXPRESS specification:

```
*)
ENTITY spec_info_content_composition
  ABSTRACT SUPERTYPE OF (ONEOF(spec_info_content_assembly,
                               spec_info_content_collection))
  SUBTYPE OF(composition);
  whole                        :  specific_information_content;
  part                         :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

whole	The information content acting as the whole for the composition.
part	The information content acting as the part for the composition.

6.5.151 spec_info_content_holding_by_fac

A type of association indicating that specific information content is held by a facility.

EXPRESS specification:

```
*)
ENTITY spec_info_content_holding_by_fac
  SUBTYPE OF(association);
  info_carrier                 :  facility;
  content                      :  specific_information_content;
END_ENTITY;
```

```
(*
```

Attribute definitions:

info_carrier	The facility acting as the information carrier for the specific information content.
content	The specific information content acting as the information in the association.

6.5.152 spec_info_content_holding_by_pob

A type of association indicating that information content has an external representation as the shape, form or state of a physical object.

EXPRESS specification:

```
*)
ENTITY spec_info_content_holding_by_pob
  SUBTYPE OF(association);
  info_carrier                 :  physical_object;
  content                      :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

info_carrier	The physical object acting as the information carrier for the specific information content.
content	The specific information content acting as the information in the association.

6.5.153 spec_physical_obj_composition

A type of composition association indicating a specific physical object, the part, is a part of another specific physical object, the whole. Composition must be specialised to be a collection or an assembly, where assembly implies some structure of the parts.

EXPRESS specification:

```
*)
ENTITY spec_physical_obj_composition
  ABSTRACT SUPERTYPE OF (ONEOF(specific_physical_obj_assembly, spe-
                               cific_physical_obj_collection))
  SUBTYPE OF(composition);
  whole                        :  specific_physical_object;
  part                         :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

whole	The specific physical object acting as the whole in the composition.
part	The specific physical object acting as the part in the composition.

6.5.154 specialisation

A type of association that indicates that all members of a subclass class are members of the superclass class. The subclass members satisfy all criteria of membership for the superclass as well as any additional criteria defined for the subclass. This is often referred to as inheritance by class. Specialisation implies a reduction of generality, in which more constraining criteria are applied to the

subclass membership than are applied to the superclass membership.The association is transitive and non symetric.

EXPRESS specification:

```
 *)
 ENTITY specialisation
   ABSTRACT SUPERTYPE OF (ONEOF(func_object_class_specialisation,
                                cha_class_specialisation, activ-
                                ity_class_specialisation,
                                phys_object_class_specialisation,
                                info_content_cl_specialisation,
                                class_of_class_specialisation))
   SUBTYPE OF(association);
 END_ENTITY;


(*
```

6.5.155 specific_activity

A type of activity that is specific, with the highest degree of particularity.

EXPRESS specification:

```
 *)
 ENTITY specific_activity
   SUBTYPE OF(activity);
 INVERSE
   composition_part             :  SET OF specific_activity_composition
                                FOR part;
   composition_whole            :  SET OF specific_activity_composition
                                FOR whole;
   fulfilment_outcome           :  SET OF specific_activity_fulfilment FOR
                                outcome;
   fulfilment_expectation       :  SET OF specific_activity_fulfilment FOR
                                expectation;
   sequence_predecessor         :  SET OF specific_activity_sequence FOR
                                predecessor;
   version_b                    :  SET OF specific_activity_version FOR
                                version_b;
   version_a                    :  SET OF specific_activity_version FOR
                                version_a;
   sequence_successor           :  SET OF specific_activity_sequence FOR
                                successor;
 END_ENTITY;
 (*
```

Attribute definitions:

composition_part	The specific activity composition this specific activity is involved with as the part.
composition_whole	The specific activity composition this specific activity is involved with as the whole.
fulfilment_outcome	The specific activity fulfilment associations this specific activity is involved with as the outcome.
fulfilment_expectation	The specific activity fulfilment associations this specific activity is involved with as the expectation.
sequence_predecessor	The specific activity sequence associations this specific activ-

	ity is involved in as the predecessor.
version_b	The specific activity version associations this specific activity is involved in as version b.
version_a	The specific activity version associations this specific activity is involved in as version a.
sequence_successor	The specific activity sequence association this specific activity is involved with as the predecessor.

6.5.156 specific_activity_assembly

A type of composition association indicating that one specific activity, the part, is a part of another specific activity, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
 *)
 ENTITY specific_activity_assembly
   SUBTYPE OF(specific_activity_composition);
 END_ENTITY;


(*
```

6.5.157 specific_activity_collection

A type of composition association indicating that one specific activity, the part, is part of a collection of specific activities, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
 *)
 ENTITY specific_activity_collection
   SUBTYPE OF(specific_activity_composition);
 END_ENTITY;


(*
```

6.5.158 specific_activity_composition

A type of composition association indicating that a specific activity, the part, is part of another specific activity, the whole. Activities may be part of other activities simultaneously and sequentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
 *)
 ENTITY specific_activity_composition
   ABSTRACT SUPERTYPE OF (ONEOF(specific_activity_assembly, spe-
                               cific_activity_collection))
   SUBTYPE OF(composition);
   whole                      :  specific_activity;
   part                       :  specific_activity;
 END_ENTITY;
 (*
```

Attribute definitions:

whole	The specific activity that acts as the whole in the composition.
part	The specific activity that acts as the part in the composition.

6.5.159 specific_activity_fulfilment

A type of fulfilment association between specific activities at different life cycle states indicating that one specific activity (the outcome) fulfils the intent implicit in the expected specific facility. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY specific_activity_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                    :  specific_activity;
  expectation                :  specific_activity;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The specific activity acting as the outcome in the fulfilment association.
expectation	The specific activity acting as the expectation in the fulfilment association.

6.5.160 specific_activity_sequence

A type of sequence association indicating that a specific activity, the successor, follows another specific activity, the predecessor, in time.

EXPRESS specification:

```
*)
ENTITY specific_activity_sequence
  SUBTYPE OF(sequence);
  successor                  :  specific_activity;
  predecessor                :  specific_activity;
END_ENTITY;
(*
```

Attribute definitions:

successor	The specific activity acting as the successor in a sequence association.
predecessor	The specific activity acting as the predecessor in a specific activity sequence association.

6.5.161 specific_activity_version

A type of version association that indicates that a specific activity, version b, is in a form where some details are different or have been changed from the form of another specific activity, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY specific_activity_version
  SUBTYPE OF(version);
  version_a                  :  specific_activity;
  version_b                  :  specific_activity;
END_ENTITY;
```

```
(*
```

Attribute definitions:

version_a	The specific activity acting as version a in the version association.
version_b	The specific activity acting as the version b in the version association.

6.5.162 specific_characteristic

A type of characteristic that is a particular observable quality. For example: the degree of hotness described by 27 degrees Centigrade, the shape of a screw thread, the openness of a door, the coordinates in a coordinate system.

EXPRESS specification:

```
*)
ENTITY specific_characteristic
  ABSTRACT SUPERTYPE OF (ONEOF(specific_curve, specific_point, spe-
                               cific_surface, specific_volume))
  SUBTYPE OF(characteristic);
INVERSE
  composition_part             :  SET OF spec_characteristic_composition
                                  FOR part;
  composition_whole            :  SET OF spec_characteristic_composition
                                  FOR whole;
  fulfilment_outcome           :  SET OF spec_characteristic_fulfilment
                                  FOR outcome;
  fulfilment_expectation       :  SET OF spec_characteristic_fulfilment
                                  FOR expectation;
  act_basis_characteristic     :  SET OF cha_basis_for_act_class_membersh
                                  FOR characteristic;
  fob_basis_characteristic     :  SET OF cha_basis_for_fob_class_membersh
                                  FOR characteristic;
  pob_basis_characteristic     :  SET OF cha_basis_for_pob_cl_membership
                                  FOR characteristic;
  cha_basis_characteristic     :  SET OF cha_basis_for_cha_cl_membership
                                  FOR characteristic;
  comparison_compared_to       :  SET OF spec_characteristic_comparison
                                  FOR compared_to;
  comparison_compared          :  SET OF spec_characteristic_comparison
                                  FOR compared;
END_ENTITY;
(*
```

Attribute definitions:

composition_part	The characteristic composition associations this specific characteristic is involved with as the part.
composition_whole	The characteristic compositions this specific characteristic is involved with as the whole.
fulfilment_outcome	The specific characteristic fulfilment associations this specific characteristic is involved with as the outcome.
fulfilment_expectation	The specific characteristic fulfilment associations this specific characteristic is involved with as the expectation.
act_basis_characteristic	The characteristic basis for activity class membership associations this specific characteristic is involved with as the characteristic.

fob_basis_characteristic	The characteristic basis for functional object class membership this characteristic is involved with as the characteristic.
pob_basis_characteristic	The characteristic basis for physical object class membership this characteristic is involved with as the characteristic.
cha_basis_characteristic	The characteristic basis for characteristic class membership association this characteristic is involved with as the basis for membership.
comparison_compared_to	The specific characteristic comparison associations this specific property is involved with as the compared_to.
comparison_compared	The specific characteristic comparison associations this specific characteristic is involved with as the compared.

6.5.163 specific_complex_object

A type of complex object that is a particular collection of things of different types (i.e. of objects that may come from more than one generic entity type). For example: the classes, information contents, characteristics and associations which make up the STEPlib standard data. Another example would be to identify all things (objects and associations) that define a design case.

EXPRESS specification:

```
 *)
 ENTITY specific_complex_object
   SUBTYPE OF(complex_object);
 INVERSE
   classification_member        :  SET OF complex_object_classification
                                FOR member;
   inclusion_includer           :  SET OF inclusion FOR includer;
 END_ENTITY;
 (*
```

Attribute definitions:

classification_member	The complex object classification associations this specific complex object is involved with as the member.
inclusion_includer	The inclusion associations this specific complex object is involved with as the includer.

6.5.164 specific_curve

A type of charecteristic that is a continuum with one degree of freedom.

EXPRESS specification:

```
 *)
 ENTITY specific_curve
   SUBTYPE OF(specific_characteristic);
 END_ENTITY;


(*
```

6.5.165 specific_facility

A type of facility that is a particular performer role for equipment and other materials.

EXPRESS specification:

```
 *)
 ENTITY specific_facility
   SUBTYPE OF(facility);
```

```
INVERSE
  connection_side_b            :  SET OF specific_facility_connection FOR
                                  side_b;
  connection_side_a            :  SET OF specific_facility_connection FOR
                                  side_a;
  composition_whole            :  SET OF specific_facility_composition
                                  FOR whole;
  transportation_transporter   :  SET OF transportation FOR transporter;
  storage_store                :  SET OF storage FOR store;
  composition_part             :  SET OF specific_facility_composition
                                  FOR part;
  fulfilment_outcome           :  SET OF specific_facility_fulfilment FOR
                                  outcome;
  fulfilment_expectation       :  SET OF specific_facility_fulfilment FOR
                                  expectation;
  version_b                    :  SET OF specific_facility_version FOR
                                  version_b;
  version_a                    :  SET OF specific_facility_version FOR
                                  version_a;
  fac_protection_protector     :  SET OF specific_facility_protection FOR
                                  protector;
  fac_protection_protected     :  SET OF specific_facility_protection FOR
                                  protected;
  usage_used                   :  SET OF usage_of_spec_fac_in_connection
                                  FOR used;
END_ENTITY;
(*
```

Attribute definitions:

connection_side_b	The connections to other facilities this specific facility is involved in as side b.
connection_side_a	The facility connections this specific facility is involved with as side a.
composition_whole	The facility compositions this specific facility is involved with as the whole.
transportation_transporter	The transportation associations this facility is involved with as the transporter.
storage_store	The storage associations this facility is involved with as the store.
composition_part	The specific facility compositions this specific facility is involved with as the part.
fulfilment_outcome	The specific facility fulfilment associations this specific facility is involved with as the outcome.
fulfilment_expectation	The specific facility fulfilment associations this specific facility is involved with as the expectation.
version_b	The specific facility version associations this specific facility is involved with as version b.
version_a	The specific facility version associations this specific facility is involved with as version a.
fac_protection_protector	The specific facility protection associations this specific facility is involved in as the protector
fac_protection_protected	The specific facility protection association this specific facility is involved in as the protected.
usage_used	The usage of specific facility in connection associations this specific facility is involved in as the used.

6.5.166 specific_facility_assembly

A type of composition association indicating that one facility is acting as a part of another whole facility. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
 *)
 ENTITY specific_facility_assembly
    SUBTYPE OF(specific_facility_composition);
 END_ENTITY;


(*
```

6.5.167 specific_facility_collection

A type of composition association indicating that a facility, the part, is a part of collection of facilities, the whole. Collection implies there is no structure or intended relationships between the parts of the collection. A facility may be part of many collections sequentially and simultaneously.

EXPRESS specification:

```
 *)
 ENTITY specific_facility_collection
    SUBTYPE OF(specific_facility_composition);
 END_ENTITY;


(*
```

6.5.168 specific_facility_composition

A type of composition association indicating a specific facility, the part, is a part of a group of specific facilities, the whole. Composition must be specialised to be a collection, where the parts have no implied structure, or to be an assembly which implies structure between the parts and the whole.

EXPRESS specification:

```
 *)
 ENTITY specific_facility_composition
    ABSTRACT SUPERTYPE OF (ONEOF(specific_facility_assembly, spe-
                                 cific_facility_collection))
    SUBTYPE OF(composition);
    whole                        :  specific_facility;
    part                         :  specific_facility;
 END_ENTITY;
 (*
```

Attribute definitions:

whole	The specific facility acting as the whole in the composition.
part	The specific facility acting as the part in the composition.

6.5.169 specific_facility_connection

A type of connection association indicating two facilities are connected. The connected facilities are indicated as side_a and side_b of the connection. The function of the connection is implied by the things being connected. Two facilities classified as fluid transfer ports can be connected to describe the capability to transfer fluid from one port to another. The direction of transfer is not specified by the connection.

EXPRESS specification:

```
*)
ENTITY specific_facility_connection
  SUBTYPE OF(connection);
  side_a                        :  specific_facility;
  side_b                        :  specific_facility;
INVERSE
  usage_user                    :  SET OF usage_of_spec_fac_in_connection
                                FOR user;
END_ENTITY;
(*
```

Attribute definitions:

side_a	The specific facility acting as side a in the connection. The connection is undirected.
side_b	The specific facility acting as side b in the connection. The connection is undirected.
usage_user	The usage of specific facility in connection associations this specific facility connection is involved with as the user.

6.5.170 specific_facility_fulfilment

A type of fulfilment association between specific facilities at different life cycle states indicating that one specific facility (the outcome) fulfils the intent implicit in the expected specific facility. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY specific_facility_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                       :  specific_facility;
  expectation                   :  specific_facility;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The specific facility acting as the outcome in the fulfilment association.
expectation	The specific facility acting as the expectation in the fulfilment association.

6.5.171 specific_facility_protection

A type of association that indicates that a specific facility, the protected, is protected by another specific facility, the protector. The purpose of the protection is assumed to be to prevent an activity to take place, and can be defined by an activity class, a specific activity or a typical activity. The prevent attribute is optional.

EXPRESS specification:

```
*)
ENTITY specific_facility_protection
  SUBTYPE OF(association);
  protector                     :  specific_facility;
  protected                     :  specific_facility;
  prevented_class               :  OPTIONAL activity_class;
  prevented_activity            :  OPTIONAL activity;
```

```
END_ENTITY;
(*
```

Attribute definitions:

protector	The specific facility which purpose it is to protect another specific facility.
protected	The specific facility that is protected by another specific facility.
prevented_class	The activity class describing the type of activity that is prevented.
prevented_activity	The activity, specific or typical, that is prevented by the specific facility protection.

6.5.172 specific_facility_version

A type of version association that indicates that a specific facility, version b,is in a form where certain details are different or have been changed from the form another specific facility, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY specific_facility_version
  SUBTYPE OF(version);
  version_a                    :  specific_facility;
  version_b                    :  specific_facility;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The specific facility acting as version a in the specific facility version association.
version_b	The specific facility acting as version b in the specific facility version association.

6.5.173 specific_info_content_fulfilment

A type of fulfilment association between specific information contents at different life cycle states indicating that one specific information content (the outcome) fulfils the intent implicit in the expected specific information content. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY specific_info_content_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                      :  specific_information_content;
  expectation                  :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The specific information content acting as the outcome in the fulfilment association.
expectation	The specific information content acting as the expectation in the fulfilment association.

6.5.174 specific_info_content_sequence

A type of sequence association indicating that a specific information content, the successor, follows another specific information content, the predecessor.

EXPRESS specification:

```
*)
ENTITY specific_info_content_sequence
   SUBTYPE OF(sequence);
   successor                    :  specific_information_content;
   predecessor                  :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

successor	The specific information content acting as the successor in the specific information content sequence association.
predecessor	The specific information content acting as the predecessor in the specific information content sequence association.

6.5.175 specific_info_content_version

A type of version association that indicates that a specific information content,version b, is in a form where certain details are different or have been changed from the form another specific information content, version a, is in. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY specific_info_content_version
   SUBTYPE OF(version);
   version_a                    :  specific_information_content;
   version_b                    :  specific_information_content;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The specific information content acting as version a in the specific information content version association.
version_b	The specific information content acting as version b in the specific information content version association.

6.5.176 specific_information_content

A type of information content that is a particular representation of meaning. A particular pattern that can be interpreted. A particular significance of something. For example:these text characters; those bit strings; this sound.

EXPRESS specification:

```
*)
ENTITY specific_information_content
   SUPERTYPE OF (ONEOF(datetime, binary_object, boolean_info_content,
                              count, quantity_info_content, logi-
                              cal_info_content, text))
   SUBTYPE OF(information_content);
INVERSE
   composition_whole            :  SET OF spec_info_content_composition
                              FOR whole;
   version_b                    :  SET OF specific_info_content_version
```

```
                                FOR version_b;
   version_a                    :  SET OF specific_info_content_version
                                FOR version_a;
   fulfilment_outcome           :  SET OF specific_info_content_fulfilment
                                FOR outcome;
   fulfilment_expectation       :  SET OF specific_info_content_fulfilment
                                FOR expectation;
   holding_pob_content          :  SET OF spec_info_content_holding_by_pob
                                FOR content;
   holding_fac_content          :  SET OF spec_info_content_holding_by_fac
                                FOR content;
   composition_part             :  SET OF spec_info_content_composition
                                FOR part;
   sequence_successor           :  SET OF specific_info_content_sequence
                                FOR successor;
   sequence_predecessor         :  SET OF specific_info_content_sequence
                                FOR predecessor;
   description_descriptor       :  SET OF description FOR descriptor;
   information_basis_descriptor :  SET OF info_basis_for_class_member FOR
                                descriptor;
END_ENTITY;
(*
```

Attribute definitions:

composition_whole	The specific information content compositions this information content is involved with as the whole.
version_b	The specific information content version associations this specific information content is involved with as version b.
version_a	The specific information content version associations this specific information content is involved with as version a.
fulfilment_outcome	The specific information content associations this specific information content is involved with as the outcome.
fulfilment_expectation	The specific information content fulfilment associations this specific information content is involved with as the expectation.
holding_pob_content	The specific information content holding by physical object associations this specific information content is involved with as the content.
holding_fac_content	The specific information content holding by facility associations this specific information content is involved with as the content.
composition_part	The information content compositions this information content is involved with as the part.
sequence_successor	The specific information content sequence associations this specific information content is involved with as the successor.
sequence_predecessor	The specific information content sequence associations this specific information content is involved with as the predecessor.
description_descriptor	The descriptions this information content is involved with as the descriptor.
information_basis_descriptor	The information basis for class member association this specific information content is involved with as the descriptor.

6.5.177 specific_installation

A type of assignment association indicating that a specific physical object is installed to to act in the role of a specific facility.

EXPRESS specification:

```
 *)
 ENTITY specific_installation
   SUBTYPE OF(assignment);
 END_ENTITY;


(*
```

6.5.178 specific_organisation

A type of specific service that is a particular assembly of roles provided by people. An organisation is independent of the people that are assigned to it or employed by it at any particular time. Examples of organisation are: BP, Shell, Accounts Department.

EXPRESS specification:

```
 *)
 ENTITY specific_organisation
   SUBTYPE OF(specific_service);
 INVERSE
   authorisation_authority      :  SET OF authorisation FOR author-
                                ity_organisation;
   control_controller           :  SET OF control FOR control-
                                ler_organisation;
   production_producer          :  SET OF production FOR producer;
   pob_provision_supplier       :  SET OF physical_object_provision FOR
                                supplier;
 END_ENTITY;
 (*
```

Attribute definitions:

authorisation_authority	The authorisation associations this organisation is involved with as the authority.
control_controller	The control associations this organisation is involved with as the controller.
production_producer	The production association this specific organisation is involved in as the producer.
pob_provision_supplier	The physical object provision this specific organisation is involved in as the supplier.

6.5.179 specific_person

A type of instance object that is a particular human being or group of human beings. Person means the spirit and character and other non physical aspects of human beings. The body of a person is a physical object. It may be argued that a split personality is two persons within the same body, each person being the identifiable character.

EXPRESS specification:

```
 *)
 ENTITY specific_person
   SUBTYPE OF(instance_object);
 INVERSE
```

```
   composition_part             :  SET OF specific_person_composition FOR
                                part;
   composition_whole            :  SET OF specific_person_composition FOR
                                whole;
   classification_member        :  SET OF person_classification FOR mem-
                                ber;
   authorisation_authority      :  SET OF authorisation FOR author-
                                ity_person;
   control_controller           :  SET OF control FOR controller_person;
END_ENTITY;
(*
```

Attribute definitions:

composition_part	The person composition associations this person is involved with as the part.
composition_whole	The person composition associations this person is involved as the whole.
classification_member	The person classification associations this person is involved with as the member.
authorisation_authority	The authorisations this person acts as the authority.
control_controller	The control associations this person is involved with as the controller.

6.5.180 specific_person_composition

A type of composition association indicating that a person or group of persons, the part, is part of another group of persons, the whole.

EXPRESS specification:

```
*)
ENTITY specific_person_composition
   SUBTYPE OF(composition);
   whole                        :  specific_person;
   part                         :  specific_person;
END_ENTITY;
(*
```

Attribute definitions:

whole	The group of persons acting as the whole for this person composition association.
part	The person or group of persons acting as the part for the composition.

6.5.181 specific_phys_obj_transformation

A type of association indicating that a specific physical object, the basis, is transformed to another specific physical object, the product.

EXPRESS specification:

```
*)
ENTITY specific_phys_obj_transformation
   SUBTYPE OF(association);
   product                      :  specific_physical_object;
   basis                        :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

product	The specific physical object that is the product of the specific physical object transformation.
basis	The specific physical object acting as basis in the specific physical object transformation.

6.5.182 specific_physical_obj_assembly

A type of composition association indicating that a specific physical object, the part, is a part of another specific physical object, the whole. Assembly implies the parts have some intended structure.

EXPRESS specification:

```
 *)
 ENTITY specific_physical_obj_assembly
    SUBTYPE OF(spec_physical_obj_composition);
 END_ENTITY;


(*
```

6.5.183 specific_physical_obj_collection

A type of composition association indicating that a specific physical object, the part, is a part of a whole specific physical object. Collection implies there is no intended structure of the whole and its parts.

EXPRESS specification:

```
 *)
 ENTITY specific_physical_obj_collection
    SUBTYPE OF(spec_physical_obj_composition);
 END_ENTITY;


(*
```

6.5.184 specific_physical_obj_connection

A type of connection association indicating two specific physical objects are connected. The connected physical objects are designated as side_a and side_b. The meaning of the connection is implied by the connected physical object. The connection is undirected.

EXPRESS specification:

```
 *)
 ENTITY specific_physical_obj_connection
    SUBTYPE OF(connection);
    side_a                       :  specific_physical_object;
    side_b                       :  specific_physical_object;
 INVERSE
    usage_user                   :  SET OF usage_of_spec_pob_in_connection
                                    FOR user;
 END_ENTITY;
 (*
```

Attribute definitions:

side_a	The specific physical object connected as side a by the connection.
side_b	The specific physical object connected as side b by the connection.

usage_user	The usage of specific physical object in connection associations this specific physical object connection is involved in as the user.

6.5.185 specific_physical_obj_fulfilment

A type of fulilment association between specific physical objects at different life cycle states indicating that one specific physical object (the outcome) fulfils the intent implicit in the expected specific physical object. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY specific_physical_obj_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                    :  specific_physical_object;
  expectation                :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The specific physical object acting as the outcome in the fulfilment association.
expectation	The specific physical object acting as the expectation in the fulfilment association.

6.5.186 specific_physical_obj_protection

A type of association that indicates that a specific physical object, the protected, is protected by another specific physical object, the protector. The purpose of the protection is assumed to be to prevent an activity to take place, and can be defined by an activity class, a specific activity or a typical activity. The prevent attribute is optional. An example would be a heat tracing cable, the protector, that is installed to protect a piece of pipe, the protected, from cooling, the prevented, to avoid the content of the pipe to freeze.

EXPRESS specification:

```
*)
ENTITY specific_physical_obj_protection
  SUBTYPE OF(association);
  protector                  :  specific_physical_object;
  protected                  :  specific_physical_object;
  prevented_class            :  OPTIONAL activity_class;
  prevented_activity         :  OPTIONAL activity;
END_ENTITY;
(*
```

Attribute definitions:

protector	The specific physical object which purpose it is to protect another specific physical object.
protected	The specific physical object that is protected by another specific physical object.
prevented_class	The activity class describing the type of activity that is prevented.
prevented_activity	The activity, specific or typical, that is prevented by specific physical object protection.

6.5.187 specific_physical_obj_version

A type of version association that indicates that a specific physical object, version b, is in a form where certain details are different or have been changed from the form of another specific physical object, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY specific_physical_obj_version
  SUBTYPE OF(version);
  version_a                    :  specific_physical_object;
  version_b                    :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The specific physical object acting as version a in the specific physical object version association.
version_b	The specific physical object acting as version b in the specific physical object version association.

6.5.188 specific_physical_object

A type of physical object that is a particular thing consisting of mass, space and energy which obeys the law of physics,

EXPRESS specification:

```
*)
ENTITY specific_physical_object
  SUBTYPE OF(physical_object);
INVERSE
  fulfilment_outcome           :  SET OF specific_physical_obj_fulfilment
                                  FOR outcome;
  fulfilment_expectation       :  SET OF specific_physical_obj_fulfilment
                                  FOR expectation;
  composition_whole            :  SET OF spec_physical_obj_composition
                                  FOR whole;
  composition_part             :  SET OF spec_physical_obj_composition
                                  FOR part;
  connection_side_a            :  SET OF specific_physical_obj_connection
                                  FOR side_a;
  connection_side_b            :  SET OF specific_physical_obj_connection
                                  FOR side_b;
  version_b                    :  SET OF specific_physical_obj_version
                                  FOR version_b;
  version_a                    :  SET OF specific_physical_obj_version
                                  FOR version_a;
  transformation_product       :  SET OF specific_phys_obj_transformation
                                  FOR product;
  transformation_basis         :  SET OF specific_phys_obj_transformation
                                  FOR basis;
  transportation_transportable :  SET OF transportation FOR transport-
                                  able;
  storage_stored               :  SET OF storage FOR storable;
  pob_protection_protector     :  SET OF specific_physical_obj_protection
                                  FOR protector;
  pob_protection_protected     :  SET OF specific_physical_obj_protection
                                  FOR protected;
```

```
   usage_used                    :  SET OF usage_of_spec_pob_in_connection
                                 FOR used;
END_ENTITY;
(*
```

Attribute definitions:

fulfilment_outcome	The specific physical object fulfilment associations this specific physical object is involved with as the outcome.
fulfilment_expectation	The specific physical object fulfilment associations this specific physical object is involved with as the expectation.
composition_whole	The specific physical object compositions this specific physical object is involved with as the whole.
composition_part	The specific physical object compositions the specific physical object is involved with as the part.
connection_side_a	The specific physical object connections the specific physical object is involved with as side a.
connection_side_b	The specific physical object connections this specific physical object is involved with as side b.
version_b	The specific physical object version associations this specific physical object is involved with as version b.
version_a	The specific physical object version associations this specific physical object is involved with as version a.
transformation_product	The specific physical object transformation the specific physical object is the product of.
transformation_basis	The specific physical object transformation this specific physical object acts as the basis of.
transportation_transportable	The transportation associations this specific physical object is involved with as the transportable.
storage_stored	The storage association this specific physical object is involved with as stored.
pob_protection_protector	The specific physical object protection association this specific physical object is involved in as protector.
pob_protection_protected	The specific physical object protection associations this specific physical object is involved with as the protected.
usage_used	The usage of specific physical object in connection associations this specific physical object is involved in as the used.

6.5.189 specific_point

A type of characteristic that is a particular point. A particular continuum with no extent.

EXPRESS specification:

```
*)
ENTITY specific_point
   SUBTYPE OF(specific_characteristic);
END_ENTITY;


(*
```

6.5.190 specific_service

A type of service that is a particular role of people.

EXPRESS specification:

```
*)
ENTITY specific_service
  SUBTYPE OF(service);
INVERSE
  fulfilment_outcome          :  SET OF specific_service_fulfilment FOR
                                 outcome;
  fulfilment_expectation      :  SET OF specific_service_fulfilment FOR
                                 expectation;
  composition_whole           :  SET OF specific_service_composition FOR
                                 whole;
  composition_part            :  SET OF specific_service_composition FOR
                                 part;
  version_a                   :  SET OF specific_service_version FOR
                                 version_a;
  version_b                   :  SET OF specific_service_version FOR
                                 version_b;
END_ENTITY;
(*
```

Attribute definitions:

fulfilment_outcome	The specific service fulfilment associations this specific service is involved in as the outcome.
fulfilment_expectation	The specific service fulfilment associations this specific service is involved in as the expectation.
composition_whole	The specific service composition associations this specific service is involved with as the whole.
composition_part	The specific service composition associations this specific service is involved with as the part.
version_a	The specific service version associations this specific version is involved with as the version_a.
version_b	The specific service version associations this specific service is involved with as the version_b.

6.5.191 specific_service_assembly

A type of composition association indicating that one specific service, the part, is a part of another specific service, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY specific_service_assembly
  SUBTYPE OF(specific_service_composition);
END_ENTITY;


(*
```

6.5.192 specific_service_collection

A type of composition association indicating that one specific service, the part, is part of a collection of specific services, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
*)
ENTITY specific_service_collection
```

```
   SUBTYPE OF(specific_service_composition);
 END_ENTITY;


(*
```

6.5.193 specific_service_composition

A type of composition association indicating that a specific service, the part, is part of another specific service, the whole. Specific services may be part of other specific services simultaneously and sequentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
 *)
 ENTITY specific_service_composition
   ABSTRACT SUPERTYPE OF (ONEOF(specific_service_assembly, spe-
                               cific_service_collection))
   SUBTYPE OF(composition);
   whole                       :  specific_service;
   part                        :  specific_service;
 END_ENTITY;
 (*
```

Attribute definitions:

whole	The specific service acting as whole in the specific service composition association.
part	The specific service acting as part in the specific service composition association.

6.5.194 specific_service_fulfilment

A type of fulfillment association between specific services at different life cycle states indicating that a specific service (the outcome) fulfils the expectation service.

EXPRESS specification:

```
 *)
 ENTITY specific_service_fulfilment
   SUBTYPE OF(fulfilment);
   outcome                     :  specific_service;
   expectation                 :  specific_service;
 END_ENTITY;
 (*
```

Attribute definitions:

outcome	The specific service acting as outcome in the specific service fulfilment association.
expectation	The specific service acting as expectation in the specific service fulfilment association.

6.5.195 specific_service_version

A type of version association that indicates that a specific service, version b, is in a form where certain details are different or have been changed from the form another specific service, version a, is in. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY specific_service_version
  SUBTYPE OF(version);
  version_a                    :  specific_service;
  version_b                    :  specific_service;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The specific service acting as version_a in the specific service version association.
version_b	The specific service acting as version_b in the specific service version association.

6.5.196 specific_signal

A type of signal that is a particular flow of information.

EXPRESS specification:

```
*)
ENTITY specific_signal
  SUBTYPE OF(signal);
INVERSE
  fulfilment_outcome           :  SET OF specific_signal_fulfilment FOR
                                  outcome;
  fulfilment_expectation       :  SET OF specific_signal_fulfilment FOR
                                  expectation;
  composition_whole            :  SET OF specific_signal_composition FOR
                                  whole;
  composition_part             :  SET OF specific_signal_composition FOR
                                  part;
END_ENTITY;
(*
```

Attribute definitions:

fulfilment_outcome	The specific signal fulfilment associations this specific signal is involved in as the outcome.
fulfilment_expectation	The specific signal fulfilment associations this specific signal is involved in as the expectation.
composition_whole	The specific signal composition associations this specific signal is involved in as the whole.
composition_part	The specific signal composition associations this signal is involved in as the part.

6.5.197 specific_signal_assembly

A type of composition association indicating that one specific signal, the part, is a part of another specific signal, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY specific_signal_assembly
  SUBTYPE OF(specific_signal_composition);
END_ENTITY;


(*
```

6.5.198 specific_signal_collection

A type of compoistion association indicating that one specific signal, the part, is part of a collection of specific signals, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
 *)
 ENTITY specific_signal_collection
    SUBTYPE OF(specific_signal_composition);
 END_ENTITY;


(*
```

6.5.199 specific_signal_composition

A type of composition association indicating that a specific signal, the part, is part of another specific signal, the whole. Specific signals may be part of other specific signals simultaneously and sequentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
 *)
 ENTITY specific_signal_composition
    ABSTRACT SUPERTYPE OF (ONEOF(specific_signal_assembly, spe-
                                 cific_signal_collection))
    SUBTYPE OF(composition);
    whole                        :  specific_signal;
    part                         :  specific_signal;
 END_ENTITY;
 (*
```

Attribute definitions:

whole	The specific signal acting as the whole in the specific signal composition association.
part	The specific signal acting as the part in the specific signal composition association.

6.5.200 specific_signal_fulfilment

A type of fulfilment association between specific signals at different life cycle states indicating that one specific signal (the outcome) fulfils the intent implicit in the expected specific signal. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
 *)
 ENTITY specific_signal_fulfilment
    SUBTYPE OF(fulfilment);
    outcome                      :  specific_signal;
    expectation                  :  specific_signal;
 END_ENTITY;
 (*
```

Attribute definitions:

outcome	The specific signal acting as outcome in the specific signal fulfilment association.

expectation	The specific signal acting as expectation in the specific signal fulfilment association.

6.5.201 specific_stream

A type of flow that is particular flow of physical objects.

EXPRESS specification:

```
*)
ENTITY specific_stream
  SUBTYPE OF(stream);
INVERSE
  fulfilment_outcome          :  SET OF specific_stream_fulfilment FOR
                                 outcome;
  fulfilment_expectation      :  SET OF specific_stream_fulfilment FOR
                                 expectation;
  composition_whole           :  SET OF specific_stream_composition FOR
                                 whole;
  composition_part            :  SET OF specific_stream_composition FOR
                                 part;
END_ENTITY;
(*
```

Attribute definitions:

fulfilment_outcome	the specific stream fulfilment associations this specific stream is involved in as the outcome.
fulfilment_expectation	The specific stream fulfilment associations this specific stream is involved in as the expectation.
composition_whole	The specific stream composition associations this specific stream is involved in acting as the whole.
composition_part	The specific stream composition associations this specific stream is involved in as the part.

6.5.202 specific_stream_assembly

A type of composition association indicating that one specific stream, the part, is a part of another specific stream, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY specific_stream_assembly
  SUBTYPE OF(specific_stream_composition);
END_ENTITY;


(*
```

6.5.203 specific_stream_collection

A type composition association indicating that one specific stream, the part, is part of a collection of specific streams, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
*)
ENTITY specific_stream_collection
  SUBTYPE OF(specific_stream_composition);
```

```
END_ENTITY;
```

(*

6.5.204 specific_stream_composition

A type of composition association indicating that a specific stream, the part, is part of another specific stream, the whole. Specific streams may be part of other specific streams simultaneously and sequentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY specific_stream_composition
  ABSTRACT SUPERTYPE OF (ONEOF(specific_stream_assembly, spe-
                               cific_stream_collection))
  SUBTYPE OF(composition);
  whole                        :  specific_stream;
  part                         :  specific_stream;
END_ENTITY;
(*
```

Attribute definitions:

whole	The specific stream acting as the whole in the specific stream composition association.
part	The specific stream acting as the part in the specific stream composition association.

6.5.205 specific_stream_fulfilment

A type of fulfilment association between specific streams at different life cycle states indicating that one specific stream (the outcome) fulfils the intent implicit in the expected specific stream. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY specific_stream_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                      :  specific_stream;
  expectation                  :  specific_stream;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The specific stream acting as the outcome in the specific stream fulfilment association.
expectation	The specific stream involved in the specific stream fulfilment association as the expectation.

6.5.206 specific_surface

A type of specific characteristic that is a particular continuum with two degrees of freedom.

EXPRESS specification:

```
*)
```

```
ENTITY specific_surface
  SUBTYPE OF(specific_characteristic);
END_ENTITY;
```

(*

6.5.207 specific_volume

A type of specific characteristic that is a continuum with three degrees of freedom.

EXPRESS specification:

```
*)
ENTITY specific_volume
  SUBTYPE OF(specific_characteristic);
END_ENTITY;
```

(*

6.5.208 storage

An association indicating that a specific physical object, the storable, is stored in a specific facility, the store.

EXPRESS specification:

```
*)
ENTITY storage
  SUBTYPE OF(association);
  store                        :  specific_facility;
  storable                     :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

store	The facility acting as the store for the storage.
storable	The specific physical object that is stored at the facility.

6.5.209 stream

A type of flow that is a flow of physical objects. Examples are oil moving or intended to move through a pipe, electric current passing through a cable, and a moving line of cars.

EXPRESS specification:

```
*)
ENTITY stream
  ABSTRACT SUPERTYPE OF (ONEOF(specific_stream, typical_stream))
  SUBTYPE OF(flow);
INVERSE
  derivation_product           :  SET OF stream_derivation FOR product;
  derivation_basis             :  SET OF stream_derivation FOR basis;
END_ENTITY;
(*
```

Attribute definitions:

derivation_product	The stream derivation associations this stream is involved in as the product.

derivation_basis	The stream derivation associations this stream is involved in as the basis.

6.5.210 stream_derivation

A type of derivation association indicating that a stream, the product, has been based on the design and form of another stream, the basis.

EXPRESS specification:

```
*)
ENTITY stream_derivation
  SUBTYPE OF(derivation);
  product                    :  stream;
  basis                      :  stream;
END_ENTITY;
(*
```

Attribute definitions:

product	The stream acting as the product in the stream derivation association.
basis	The stream acting as the basis in the stream derivation association.

6.5.211 text

A type of information content representation encoded in accordance with ISO 10646.

EXPRESS specification:

```
*)
ENTITY text
  SUBTYPE OF(specific_information_content);
  text_value                 :  ndt_text;
END_ENTITY;
(*
```

Attribute definitions:

text_value	A character representation of the information content.

6.5.212 thing

Any thing, including all material and abstract things. Things are subdivided into objects and associations, and into classes, specifics and typicals. Things may be actual, planned, required or predicted (life cycle) and have creation and termination times. These delimit the valid lifetime of the thing. Things may have many descriptions, including names and other means of reference, and may possess many characteristics.

EXPRESS specification:

```
*)
ENTITY thing
  ABSTRACT SUPERTYPE OF (ONEOF(association, object));
  entity_lifecycle_qualifier  :  ndt_lifecycle;
  creation                    :  OPTIONAL datetime;
  termination                 :  OPTIONAL datetime;
INVERSE
  possession_characterised    :  SET OF characteristic_possession FOR
                                 characterised;
  description_described       :  SET OF description FOR described;
  authorisation_authorisable  :  SET OF authorisation FOR authorisable;
```

```
   inclusion_included           :  SET OF inclusion FOR included;
   assignment_player            :  SET OF assignment FOR player;
   involvement_involved         :  SET OF involvement FOR involved;
END_ENTITY;
(*
```

Attribute definitions:

entity_lifecycle_qualifier	A value indicating one of the four possible life cycle states: actual; planned; required; or predicted. Objects having different lifecycle states are considered different objects. So the qualifier attribute should not be changed after the occurence identity has been created.
creation	The date and time the thing represented by the instance came into existence.
termination	The date and time the validity or life of the thing represented by this instance is terminated.
possession_characterised	The possession associations this thing is involved with as the characterised.
description_described	The thing description associations this thing is involved with as the described.
authorisation_authorisable	The authorisation associations this thing is involved with as the authorised.
inclusion_included	The inclusion associations this thing is involved with as the included.
assignment_player	The assignment associations this thing is involved in as the player.
involvement_involved	The involvement associations this thing is involved with as the involved.

6.5.213 transportation

A type of association indicating a physical object, the transportable, is transported by a facility, the transporter.

EXPRESS specification:

```
*)
ENTITY transportation
   SUBTYPE OF(association);
   transporter                  :  specific_facility;
   transportable                :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

transporter	The facility performing the transport of the transportation association.
transportable	The physical object transported by the transporter facility.

6.5.214 typ_characteristic_assembly

A type of composition association indicating that one typical characteristic is acting as a part of another typical characteristic, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY typ_characteristic_assembly
   SUBTYPE OF(typ_characteristic_composition);
```

```
END_ENTITY;
```

(*

6.5.215 typ_characteristic_collection

A type of composition association indicating that a typical characteristic, the part, is part of a collection of typical characteristics, the whole. Collection implies there is no structure or intended relationships between the parts of the collection.

EXPRESS specification:

```
*)
ENTITY typ_characteristic_collection
   SUBTYPE OF(typ_characteristic_composition);
END_ENTITY;
```

(*

6.5.216 typ_characteristic_composition

A type of composition association indicating that the typical characteristic, the part, is part of another typical characteristic, the whole.

EXPRESS specification:

```
*)
ENTITY typ_characteristic_composition
   ABSTRACT SUPERTYPE OF (ONEOF(typ_characteristic_assembly,
                                typ_characteristic_collection))
   SUBTYPE OF(composition);
   whole                        :  typical_characteristic;
   part                         :  typical_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical characteristic acting as the whole in the composition of typical characteristic.
part	The typical characteristic acting as the part in the composition of typical characteristic.

6.5.217 typ_characteristic_factorisation

A type of characteristic assembly association that indicates that one typical characteristic, the part, is a multiplier factor of a typical characteristic, the whole. The exponent on the multiplier is defined by the attribute exponent. A whole typical characteristic may consist of the product of 'n' terms, where each term is the part typical characteristic of a typical characteristic factorisation association, raised to the power of the exponent.

EXPRESS specification:

```
*)
ENTITY typ_characteristic_factorisation
   SUBTYPE OF(typ_characteristic_assembly);
   exponent                     :  REAL;
END_ENTITY;
(*
```

Attribute definitions:

exponent	The exponent of the typical characteristic that acts as the multiplier part in the typical characteristic factorisation association.

6.5.218 typ_characteristic_fulfilment

A type of fulfilment association between typical characteristics at different life cycle states indicating that one typical characteristic (the outcome) fulfils the intent implicit in the expected typical characteristic. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typ_characteristic_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                    :  typical_characteristic;
  expectation                :  typical_characteristic;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical characteristic acting as the outcome in the fulfilment association.
expectation	The typical characteristic acting as the expectation in the fulfilment association.

6.5.219 typical_activity

A type of activity that is a representative or re usable design of an activity. A typical activity may be used as a basis for defining many specific activities. A typical activity is often parameterised e.g. the times of execution may not be specified and can be set when deriving a specific activity. A repeatable procedure or method is a typical activity.

EXPRESS specification:

```
*)
ENTITY typical_activity
  SUBTYPE OF(activity);
INVERSE
  composition_whole          :  SET OF typical_activity_composition FOR
                               whole;
  composition_part           :  SET OF typical_activity_composition FOR
                               part;
  sequence_successor         :  SET OF typical_activity_sequence FOR
                               successor;
  sequence_predecessor       :  SET OF typical_activity_sequence FOR
                               predecessor;
  fulfilment_outcome         :  SET OF typical_activity_fulfilment FOR
                               outcome;
  fulfilment_expectation     :  SET OF typical_activity_fulfilment FOR
                               expectation;
  version_b                  :  SET OF typical_activity_version FOR
                               version_b;
  version_a                  :  SET OF typical_activity_version FOR
                               version_a;
END_ENTITY;
(*
```

Attribute definitions:

composition_whole	The typical activity compositions this typical activity is involved with as the whole.
composition_part	The typical activity compositions the typical activity is involved with as the part.
sequence_successor	The typical sequence associations this typical activity is involved with as the successor.
sequence_predecessor	The typical activity sequences this typical activity is involved with as the predecessor.
fulfilment_outcome	The typical activity fulfilment associations this typical activity is involved with as the outcome; its life cycle state indicates fulfilment outcome.
fulfilment_expectation	The typical activity fulfilment associations this typical activity is involved with as the expectation.
version_b	The typical activity version association this typical activity is involved with as version b.
version_a	The typical activity version association this typical activity is involved with as version a.

6.5.220 typical_activity_assembly

A type of composition association indicating a typical activity, the part, is a part of another typical activity, the whole. Assembly implies that the parts of a whole have some structure.

EXPRESS specification:

```
 *)
 ENTITY typical_activity_assembly
    SUBTYPE OF(typical_activity_composition);
 END_ENTITY;


(*
```

6.5.221 typical_activity_collection

A type of composition association indicating a typical activity, the part, is part of a collection of typical activities, the whole. Collection implies there is no structure of the parts of the whole.

EXPRESS specification:

```
 *)
 ENTITY typical_activity_collection
    SUBTYPE OF(typical_activity_composition);
 END_ENTITY;


(*
```

6.5.222 typical_activity_composition

A type of composition association indicating a typical activity, the part, is part of another typical activity, the whole. Composition must be specialised to be either a collection or an assembly.

EXPRESS specification:

```
 *)
 ENTITY typical_activity_composition
```

```
   ABSTRACT SUPERTYPE OF (ONEOF(typical_activity_assembly, typi-
                               cal_activity_collection))
   SUBTYPE OF(composition);
   whole                       :  typical_activity;
   part                        :  typical_activity;
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical activity that acts as the whole for the typical composition.
part	The typical activity acting as the part of the typical composition.

6.5.223 typical_activity_fulfilment

A type of fulfilment association between typical activities at different life cycle states indicating that one typical activity (the outcome) fulfils the intent implicit in the expected typical activity. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typical_activity_fulfilment
   SUBTYPE OF(fulfilment);
   outcome                     :  typical_activity;
   expectation                 :  typical_activity;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical activity with a life cycle state indicating fulfilment outcome, acting as the outcome in the fulfilment association.
expectation	The typical activity acting as the expectation in the fulfilment association.

6.5.224 typical_activity_sequence

A type of sequence association indicating one typical activity, the successor, follows another typical activity, the predecessor, in time.

EXPRESS specification:

```
*)
ENTITY typical_activity_sequence
   SUBTYPE OF(sequence);
   successor                   :  typical_activity;
   predecessor                 :  typical_activity;
END_ENTITY;
(*
```

Attribute definitions:

successor	The typical activity involved in typical activity sequence associations as the successor.
predecessor	The typical activity acting as the predecessor in the typical sequence association.

6.5.225 typical_activity_version

A type of version association indicating that a typical activity, version b, is in a form where some details are different or have been changed from the form of another typical activity, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY typical_activity_version
  SUBTYPE OF(version);
  version_a                    :  typical_activity;
  version_b                    :  typical_activity;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The typical activity acting as version a in the version association.
version_b	The typical activity acting as version b in the version association.

6.5.226 typical_characteristic

A type of characteristic that is a representative for specific characteristics such as a standardised length or a parameterised point. Subtypes of typical characteristic are typical point,typical curve, typical surface and typical volume.

EXPRESS specification:

```
*)
ENTITY typical_characteristic
  ABSTRACT SUPERTYPE OF (ONEOF(typical_point, typical_curve, typi-
                               cal_surface, typical_volume))
  SUBTYPE OF(characteristic);
INVERSE
  composition_whole            :  SET OF typ_characteristic_composition
                                  FOR whole;
  composition_part             :  SET OF typ_characteristic_composition
                                  FOR part;
  fulfilment_outcome           :  SET OF typ_characteristic_fulfilment
                                  FOR outcome;
  fulfilment_expectation       :  SET OF typ_characteristic_fulfilment
                                  FOR expectation;
END_ENTITY;
(*
```

Attribute definitions:

composition_whole	The typical characteristic compositions this typical characteristic is involved with as the whole.
composition_part	The typical characteristic compositions this typical characteristic is involved with as the part.
fulfilment_outcome	The typical characteristic fulfilment associations this typical characteristic is involved with as the outcome.
fulfilment_expectation	The typical characteristic fulfilment associations this typical characteristic is involved with as the expectation.

6.5.227 typical_curve

A type of typical characteristic that is a representative or parameterised continuum with one degree

of freedom (a parameterised curve). For example the curve given by y=ax + b, where a and b are undetermined.

EXPRESS specification:

```
 *)
 ENTITY typical_curve
   SUBTYPE OF(typical_characteristic);
 END_ENTITY;


(*
```

6.5.228 typical_facility

A type of facility that is a representative facility. A typical facility will include some parameterisation and may be the basis for implementing or creating many specific facilities.

EXPRESS specification:

```
 *)
 ENTITY typical_facility
   SUBTYPE OF(facility);
 INVERSE
   connection_side_b            :  SET OF typical_facility_connection FOR
                                   side_b;
   connection_side_a            :  SET OF typical_facility_connection FOR
                                   side_a;
   composition_whole            :  SET OF typical_facility_composition FOR
                                   whole;
   composition_part             :  SET OF typical_facility_composition FOR
                                   part;
   fulfilment_outcome           :  SET OF typical_facility_fulfilment FOR
                                   outcome;
   fulfilment_expectation       :  SET OF typical_facility_fulfilment FOR
                                   expectation;
   version_b                    :  SET OF typical_facility_version FOR
                                   version_b;
   version_a                    :  SET OF typical_facility_version FOR
                                   version_a;
   usage_used                   :  SET OF usage_of_typ_fac_in_connection
                                   FOR used;

 END_ENTITY;
 (*
```

Attribute definitions:

connection_side_b	The typical connections this typical facility is involved with as side b.
connection_side_a	The typical connections this typical facility is involved with as side a.
composition_whole	The typical compositions this typical facility is involved in as the whole.
composition_part	The typical compositions this typical facility is involved in as the part.
fulfilment_outcome	The typical facility fulfilment associations this typical facility is involved with as the outcome.
fulfilment_expectation	The typical facility fulfilment associations this typical facility is involved with as the expectation.

version_b	The typical facility version associations this typical facility is involved with as version b.
version_a	The typical facility version associations this typical facility is involved with as version a.
usage_used	The usage of typical facility in connection associations this typical facility is involved in as the used.

6.5.229 typical_facility_assembly

A type of composition association indicating that one typical facility is acting as the part of a whole typical facility. Assembly implies there is some intended structure of the parts.

EXPRESS specification:

```
 *)
 ENTITY typical_facility_assembly
   SUBTYPE OF(typical_facility_composition);
 END_ENTITY;
```

(*

6.5.230 typical_facility_collection

A type of composition association indicating a typical facility, the part, is part of another typical facility, the whole. Collection implies no structure amongst the parts of the whole.

EXPRESS specification:

```
 *)
 ENTITY typical_facility_collection
   SUBTYPE OF(typical_facility_composition);
 END_ENTITY;
```

(*

6.5.231 typical_facility_composition

A type of composition association indicating a typical facility, the part, is part of another typical facility, the whole. Composition must be specialised to be either an assembly or a collection.

EXPRESS specification:

```
 *)
 ENTITY typical_facility_composition
   ABSTRACT SUPERTYPE OF (ONEOF(typical_facility_assembly, typi-
                                cal_facility_collection))
   SUBTYPE OF(composition);
   whole                        :  typical_facility;
   part                         :  typical_facility;
 END_ENTITY;
 (*
```

Attribute definitions:

whole	The typical facility that acts as the whole in the typical composition.
part	The typical facility that acts as the part in the typical composition.

6.5.232 typical_facility_connection

A type of connection association indicating a typical facility is connected in the role of side a to another typical facility in the role of side b. The connection is undirected. The function of the connection is implied by the things being connected. Two typical facilities classified as fluid transfer ports can be connected to describe the capability to transfer fluid from one port to another and vice versa.

EXPRESS specification:

```
*)
ENTITY typical_facility_connection
  SUBTYPE OF(connection);
  side_a                      :  typical_facility;
  side_b                      :  typical_facility;
INVERSE
  usage_user                  :  SET OF usage_of_typ_fac_in_connection
                                 FOR user;
END_ENTITY;
(*
```

Attribute definitions:

side_a	The typical facility that acts as side a in the typical connection. The connection is undirected.
side_b	The typical facility that acts as side b in the typical connection. The connection is undirected.
usage_user	The usage of typical facility in connection associations this typical facility connection is involved in as the user.

6.5.233 typical_facility_fulfilment

A type of fulfilment association between typical facilities at different life cycle states indicating that one typical facility (the outcome) fulfils the intent implicit in the expected typical facility. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typical_facility_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                     :  typical_facility;
  expectation                 :  typical_facility;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical facility acting as the outcome in the fulfilment association.
expectation	The typical facility acting as the expectation in the fulfilment association.

6.5.234 typical_facility_version

A type of version association that indicates that a typical facility, version b, is in a form where certain details are different or have been changed from the form another typical facility, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY typical_facility_version
```

```
   SUBTYPE OF(version);
   version_a                    :  typical_facility;
   version_b                    :  typical_facility;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The typical facility acting as version a in the typical facility version association.
version_b	The typical facility acting as the version b in the typical facility version associations.

6.5.235 typical_info_content_assembly

A type of composition association indicating that one typical information content, the part, is acting as a part of another typical information content, the whole.Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY typical_info_content_assembly
   SUBTYPE OF(typical_info_content_composition);
END_ENTITY;


(*
```

6.5.236 typical_info_content_collection

A type of composition association indicating that a typical information content, the part, is a part of collection of typical information contents, the whole. Collection implies there is no structure or intended relationships between the parts of the collection. A typical information content may be part of many collections sequentially and simultaneously.

EXPRESS specification:

```
*)
ENTITY typical_info_content_collection
   SUBTYPE OF(typical_info_content_composition);
END_ENTITY;


(*
```

6.5.237 typical_info_content_composition

A type of composition association indicating that a typical information content, the part, is a part of another typical information content, the whole. Composition must be specialised to be either an assembly or a collection.

EXPRESS specification:

```
*)
ENTITY typical_info_content_composition
   ABSTRACT SUPERTYPE OF (ONEOF(typical_info_content_assembly, typi-
                               cal_info_content_collection))
   SUBTYPE OF(composition);
   whole                        :  typical_information_content;
   part                         :  typical_information_content;
```

```
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical information content acting as the whole for the composition.
part	The typical information content that is the part for the composition association.

6.5.238 typical_info_content_fulfilment

A type of fulfilment association between typical information contents at different life cycle states indicating that one typical information contents (the outcome) fulfils the intent (expectation) implicit in the other typical information content. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typical_info_content_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                    :  typical_information_content;
  expectation                :  typical_information_content;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical information content acting as the outcome in the fulfilment association.
expectation	The typical information content acting as the expectation in the fulfilment association.

6.5.239 typical_info_content_sequence

A type of sequence association indicating that a typical information content, the successor, follows after another typical information content, the predecessor.

EXPRESS specification:

```
*)
ENTITY typical_info_content_sequence
  SUBTYPE OF(sequence);
  successor                  :  typical_information_content;
  predecessor                :  typical_information_content;
END_ENTITY;
(*
```

Attribute definitions:

successor	The typical information content acting as the successor in the typical information content sequence association.
predecessor	The typical information content acting as the predecessor in the typical information content sequence association.

6.5.240 typical_info_content_version

A type of version association that indicates that a typical information content, version b, is in a form where certain details are different or have been changed from the form another typical information content, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY typical_info_content_version
  SUBTYPE OF(version);
  version_a                    :  typical_information_content;
  version_b                    :  typical_information_content;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The typical information content acting as version a in the typical information content version association.
version_b	The typical information content acting as version b in the typical information content version association.

6.5.241 typical_information_content

A type of information content that is a representative, parameterised, reusable representation of information. For example the sentence template [x] lives at [y], where x and y are descriptors of a person and a place, respectively, which are given values to form a specific information content.

EXPRESS specification:

```
*)
ENTITY typical_information_content
  SUBTYPE OF(information_content);
INVERSE
  composition_part             :  SET OF typical_info_content_composition
                                  FOR part;
  composition_whole            :  SET OF typical_info_content_composition
                                  FOR whole;
  fulfilment_outcome           :  SET OF typical_info_content_fulfilment
                                  FOR outcome;
  fulfilment_expectation       :  SET OF typical_info_content_fulfilment
                                  FOR expectation;
  version_b                    :  SET OF typical_info_content_version FOR
                                  version_b;
  version_a                    :  SET OF typical_info_content_version FOR
                                  version_a;
  sequence_successor           :  SET OF typical_info_content_sequence
                                  FOR successor;
  sequence_predecessor         :  SET OF typical_info_content_sequence
                                  FOR predecessor;
END_ENTITY;
(*
```

Attribute definitions:

composition_part	The typical information content compositions this typical information content is involved with as the part.
composition_whole	The typical information content compositions this typical information content is involved with as the whole.
fulfilment_outcome	The typical information content fulfilment associations this typical information content is involved with as the outcome.
fulfilment_expectation	The typical information content fulfilment associations this typical information content is involved with as the expectation.
version_b	The typical information content version associations this typical information content is involved with as version b.
version_a	The typical information content version associations this typical

	information content is involved with as version a.
sequence_successor	The typical information content sequence associations this typical information content is involved with as the successor.
sequence_predecessor	The typical information content sequence associations this typical information content is involved with as the predecessor.

6.5.242 typical_installation

A type of assignment association indicating that a physical object, typical or specific, could be installed to act in the role of a facility.

EXPRESS specification:

```
 *)
 ENTITY typical_installation
    SUBTYPE OF(assignment);
 END_ENTITY;


(*
```

6.5.243 typical_physical_obj_assembly

A type of composition association indicating that one typical physical object is acting as a part for a whole typical physical object. Assembly implies there to be some structure of the parts of the whole.

EXPRESS specification:

```
 *)
 ENTITY typical_physical_obj_assembly
    SUBTYPE OF(typical_physical_obj_composition);
 END_ENTITY;


(*
```

6.5.244 typical_physical_obj_collection

A type of composition association indicating a typical physical object, the part, is part of another typical physical object, the whole. Collections have no implied structure for parts of the whole.

EXPRESS specification:

```
 *)
 ENTITY typical_physical_obj_collection
    SUBTYPE OF(typical_physical_obj_composition);
 END_ENTITY;


(*
```

6.5.245 typical_physical_obj_composition

A type of composition association indicating that a typical physical object, the part, is a part of another typical physical object, the whole. Composition must be specialised to be either a collection or an assembly.

EXPRESS specification:

```
 *)
 ENTITY typical_physical_obj_composition
```

```
   ABSTRACT SUPERTYPE OF (ONEOF(typical_physical_obj_assembly, typi-
                                cal_physical_obj_collection))
   SUBTYPE OF(composition);
   whole                        :  typical_physical_object;
   part                         :  typical_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical physical object acting as the whole for the composition.
part	The typical physical object acting as the part for the composition.

6.5.246 typical_physical_obj_connection

A type of connection association indicating that a typical physical object is connected as side_a to another typical physical object as side_b. The connection is undirected, and implies direct physical contact is intended between the two sides.

EXPRESS specification:

```
*)
ENTITY typical_physical_obj_connection
   SUBTYPE OF(connection);
   side_a                       :  typical_physical_object;
   side_b                       :  typical_physical_object;
INVERSE
   usage_user                   :  SET OF usage_of_typ_pob_in_connection
                                FOR user;
END_ENTITY;
(*
```

Attribute definitions:

side_a	The typical physical object acting as side a of the connection.
side_b	The typical physical object acting as side b of the connection.
usage_user	The usage of typical physical object in connection association this typical physical object connection association is involved in as the user.

6.5.247 typical_physical_obj_fulfilment

A type of fulfilment association between typical physical objects at different life cycle states indicating that one typical physical object (the outcome) fulfils the intent (expectation) implicit in the other typical physical object. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typical_physical_obj_fulfilment
   SUBTYPE OF(fulfilment);
   outcome                      :  typical_physical_object;
   expectation                  :  typical_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical physical object acting as the outcome in the fulfil-

	ment association.
expectation	The typical physical object acting as the expectation in the fulfilment association.

6.5.248 typical_physical_obj_version

A type of version association that indicates that a typical physical object, version b, is in a form where certain details are different or have been changed from the form of another typical physical object, version a. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY typical_physical_obj_version
  SUBTYPE OF(version);
  version_a                    :  typical_physical_object;
  version_b                    :  typical_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The typical physical object acting as version a in the typical physical object version association.
version_b	The typical physical object acting as version b in the typical physical object version association.

6.5.249 typical_physical_object

A type of physical object that is a representative of or reusable design of physical objects. A typical physical object will often imply some parameterisation, e.g. mass is indeterminate, and may be the basis for producing or creating many specific physical objects. Facilities are often designed to process typical physical objects.

EXPRESS specification:

```
*)
ENTITY typical_physical_object
  SUBTYPE OF(physical_object);
INVERSE
  composition_whole            :  SET OF typical_physical_obj_composition
                                  FOR whole;
  connection_side_b            :  SET OF typical_physical_obj_connection
                                  FOR side_b;
  connection_side_a            :  SET OF typical_physical_obj_connection
                                  FOR side_a;
  fulfilment_outcome           :  SET OF typical_physical_obj_fulfilment
                                  FOR outcome;
  fulfilment_expectation       :  SET OF typical_physical_obj_fulfilment
                                  FOR expectation;
  version_b                    :  SET OF typical_physical_obj_version FOR
                                  version_b;
  version_a                    :  SET OF typical_physical_obj_version FOR
                                  version_a;
  composition_part             :  SET OF typical_physical_obj_composition
                                  FOR part;
  usage_used                   :  SET OF usage_of_typ_pob_in_connection
                                  FOR used;
  typification_basis_typifier  :  SET OF typification_basis_pob_cl_member
                                  FOR typifier;
```

```
END_ENTITY;
(*
```

Attribute definitions:

composition_whole	The typical compositions this typical physical object is involved with as the whole.
connection_side_b	The typical connections this typical physical object is involved with as side b.
connection_side_a	The typical connections this typical physical object is involved with as side a.
fulfilment_outcome	The typical physical object fulfilment associations this typical physical object is involved with as the expectation.
fulfilment_expectation	The typical physical object fulfilment associations this typical physical object is involved with as the outcome.
version_b	The typical physical object version associations this typical physical object is involved with as version b.
version_a	The typical physical object version associations this typical physical object is involved with as version a.
composition_part	The typical compositions this typical physical object is involved with as the part.
usage_used	The usage of typical physical object in connection association this typical physical object is involved in as the used.
typification_basis_typifier	The typification basis for physical object class membership associations this typical physical object is involved with as the typifier.

6.5.250 typical_point

A type of typical characteristic that is representative or parameterised point. For example, the temperature considered as a variable.

EXPRESS specification:

```
*)
ENTITY typical_point
   SUPERTYPE OF (ONEOF(dimension, unit_of_measure))
   SUBTYPE OF(typical_characteristic);
END_ENTITY;


(*
```

6.5.251 typical_service

A type of service that is a representative or re usable design for specific services or a category of services (a class).

EXPRESS specification:

```
*)
ENTITY typical_service
   SUBTYPE OF(service);
INVERSE
   fulfilment_outcome           :  SET OF typical_service_fulfilment FOR
                                outcome;
   fulfilment_expectation       :  SET OF typical_service_fulfilment FOR
                                expectation;
   composition_whole            :  SET OF typical_service_composition FOR
```

```
                                whole;
   composition_part             :  SET OF typical_service_composition FOR
                                part;
   version_a                    :  SET OF typical_service_version FOR ver-
                                sion_a;
   version_b                    :  SET OF typical_service_version FOR ver-
                                sion_b;
END_ENTITY;
(*
```

Attribute definitions:

fulfilment_outcome	The typical service fulfilment associations this typical service is involved in as the outcome.
fulfilment_expectation	The typical service fulfilment associations this typical service is involved in as the expectation.
composition_whole	The typical service composition associations this typical service is involved with as the whole.
composition_part	The typical service composition associations this typical service is involved with as the part.
version_a	The typical service version associations this typical service is involved with as the version_a.
version_b	The typical service version associations this typical service is involved with as the version_b.

6.5.252 typical_service_assembly

A type of composition association indicating that one typical service, the part, is a part of another typical service, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY typical_service_assembly
   SUBTYPE OF(typical_service_composition);
END_ENTITY;


(*
```

6.5.253 typical_service_collection

A type of composition association indicating that one typical service, the part, is part of a collection of typical services, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
*)
ENTITY typical_service_collection
   SUBTYPE OF(typical_service_composition);
END_ENTITY;


(*
```

6.5.254 typical_service_composition

A type of composition association indicating that a typical service, the part, is part of another typical service, the whole. Typical services may be part of other typical services simultaneously and se-

quentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY typical_service_composition
  ABSTRACT SUPERTYPE OF (ONEOF(typical_service_assembly, typi-
                               cal_service_collection))
  SUBTYPE OF(composition);
  whole                        :  typical_service;
  part                         :  typical_service;
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical service acting as whole in the typical service composition association.
part	The typical service acting as part in the typical service composition association.

6.5.255 typical_service_fulfilment

A type of fulfilment association between typical services at different life cycle states indicating that a typical service, the outcome, fulfils the intent implicit in the expected typical service, the expectation.

EXPRESS specification:

```
*)
ENTITY typical_service_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                      :  typical_service;
  expectation                  :  typical_service;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical service acting as outcome in the typical service fulfilment association.
expectation	The typical service acting as the expectation in the typical service fulfilment association.

6.5.256 typical_service_version

A type of version association that indicates that a typical service, version b, is in a form where certain details are different or have been changed from the form another typical service, version a, is in. Different versions may coexist.

EXPRESS specification:

```
*)
ENTITY typical_service_version
  SUBTYPE OF(version);
  version_a                    :  typical_service;
  version_b                    :  typical_service;
END_ENTITY;
(*
```

Attribute definitions:

version_a	The typical service acting as version_a in the typical service version association.

version_b	The typical service acting as version_b in the typical service version association.

6.5.257 typical_signal

A type of signal that is a representative or re usable design for specific signals or categories of signals (classes).

EXPRESS specification:

```
*)
ENTITY typical_signal
  SUBTYPE OF(signal);
INVERSE
  fulfilment_outcome          :  SET OF typical_signal_fulfilment FOR
                                 outcome;
  fulfilment_expecation       :  SET OF typical_signal_fulfilment FOR
                                 expectation;
  composition_whole           :  SET OF typical_signal_composition FOR
                                 whole;
  composition_part            :  SET OF typical_signal_composition FOR
                                 part;
END_ENTITY;
(*
```

Attribute definitions:

fulfilment_outcome	The typical signal fulfilment associations this typical signal is involved in as the outcome.
fulfilment_expecation	The typical signal fulfilment association this typical signal is involved in as the expectation.
composition_whole	The typical signal composition associations this typical signal is involved in as the whole.
composition_part	The typical signal composition associations this typical signal is involved in as the part.

6.5.258 typical_signal_assembly

A type of composition association indicating that one typical signal, the part, is a part of another typical signal, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
*)
ENTITY typical_signal_assembly
  SUBTYPE OF(typical_signal_composition);
END_ENTITY;


(*
```

6.5.259 typical_signal_collection

A type of composition association indicating that one typical signal, the part, is part of a collection of typical signals, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
*)
ENTITY typical_signal_collection
  SUBTYPE OF(typical_signal_composition);
```

```
END_ENTITY;
```

(*

6.5.260 typical_signal_composition

A type of composition association indicating that a typical signal, the part, is part of another typical signal, the whole. Typical signals may be part of other typical signals simultaneously and sequentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY typical_signal_composition
  ABSTRACT SUPERTYPE OF (ONEOF(typical_signal_assembly, typi-
                               cal_signal_collection))
  SUBTYPE OF(composition);
  whole                        :  typical_signal;
  part                         :  typical_signal;
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical signal acting as the whole in the typical signal composition association.
part	The typical signal acting as the part in the typical signal composition association.

6.5.261 typical_signal_fulfilment

A type of fulfilment association between typical signals at different life cycle states indicating that one typical signal (the outcome) fulfils the intent implicit in the expected typical signal. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typical_signal_fulfilment
  SUBTYPE OF(fulfilment);
  outcome                      :  typical_signal;
  expectation                  :  typical_signal;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical signal acting as outcome in the typical signal fulfilment associaiton.
expectation	The typical signal acting as expectation in the typical signal fulfilment association.

6.5.262 typical_stream

A type of steram that is a representative or re usable design for specific streams or a category of streams. A typical stream can include some parameterisation and may be the basis for implementing or creating many specific streams.

EXPRESS specification:

```
 *)
 ENTITY typical_stream
   SUBTYPE OF(stream);
 INVERSE
   fulfilment_outcome           :  SET OF typical_stream_fulfilment FOR
                                outcome;
   fulfilment_expectation       :  SET OF typical_stream_fulfilment FOR
                                expectation;
   composition_whole            :  SET OF typical_stream_composition FOR
                                whole;
   composition_part             :  SET OF typical_stream_composition FOR
                                part;
 END_ENTITY;
 (*
```

Attribute definitions:

fulfilment_outcome	The typical stream fulfilment associations this typical stream is involved in as the outcome.
fulfilment_expectation	The typical stream fulfilment associations this typical stream is involved in as the expectation.
composition_whole	The typical stream composition associations this typical stream is involved in as the whole.
composition_part	The typical stream composition associations this typical stream is involved in as the part.

6.5.263 typical_stream_assembly

A type of composition association indicating that one typical stream, the part, is a part of another typical stream, the whole. Assembly implies the parts of the whole have some structure.

EXPRESS specification:

```
 *)
 ENTITY typical_stream_assembly
   SUBTYPE OF(typical_stream_composition);
 END_ENTITY;


(*
```

6.5.264 typical_stream_collection

A type of composition association indicating that one typical stream, the part, is part of a collection of typical streams, the whole. Collection implies there is no intended structure between parts of a whole.

EXPRESS specification:

```
 *)
 ENTITY typical_stream_collection
   SUBTYPE OF(typical_stream_composition);
 END_ENTITY;


(*
```

6.5.265 typical_stream_composition

A type of composition association indicating that a typical stream, the part, is part of another typical stream, the whole. Typical streams may be part of other typical streams simultaneously and sequentially. Composition must be specialised to be an assembly i.e.the parts having some structure, or a collection, i.e. the parts having no implied structure.

EXPRESS specification:

```
*)
ENTITY typical_stream_composition
   ABSTRACT SUPERTYPE OF (ONEOF(typical_stream_assembly, typi-
                               cal_stream_collection))
   SUBTYPE OF(composition);
   whole                       :  typical_stream;
   part                        :  typical_stream;
END_ENTITY;
(*
```

Attribute definitions:

whole	The typical stream acting as the whole in the typical stream composition association.
part	The typical stream acting as the part in the typical stream composition association.

6.5.266 typical_stream_fulfilment

A type of fulfilment association between typical streams at different life cycle states indicating that one typical stream (the outcome) fulfils the intent implicit in the expected typical stream. Allowable combinations of expected and outcome are: predicted/actual, required/actual, required/planned, planned/actual.

EXPRESS specification:

```
*)
ENTITY typical_stream_fulfilment
   SUBTYPE OF(fulfilment);
   outcome                     :  typical_stream;
   expectation                 :  typical_stream;
END_ENTITY;
(*
```

Attribute definitions:

outcome	The typical stream acting as the outcome in the typical stream fulfilment association.
expectation	The typical stream acting as the expectation in the typical stream fulfilment association.

6.5.267 typical_surface

A type of typical characteristic that is a representative or parameterised surface (continuum with two degrees of freedom). For example the surface given by x**2 + y**2 + z**2 = R**2, where R is undetermined. Fixing R would give a specific surface, classifiable as spherical.

EXPRESS specification:

```
*)
ENTITY typical_surface
   SUBTYPE OF(typical_characteristic);
END_ENTITY;
```

(*

6.5.268 typical_volume

A type of typical characteristic that is a representative or parameterised continuum with three degress of freedom. For example, the continuum of variables x,y,z where 0<=x<=A, 0<=y<=B and 0<=z<=C, where A, B and C are undetermined parameters.

EXPRESS specification:

```
*)
ENTITY typical_volume
   SUBTYPE OF(typical_characteristic);
END_ENTITY;
```

(*

6.5.269 typification_basis_pob_cl_member

A type of basis for class membership association indicating that a typical physical object is part of the basis for membership of the physical object class. To be member of the physical object class, any member must be representable by the typical physical object.

EXPRESS specification:

```
*)
ENTITY typification_basis_pob_cl_member
   SUBTYPE OF(basis_for_class_membership);
   typifier                    :  typical_physical_object;
   typified                    :  physical_object_class;
END_ENTITY;
(*
```

Attribute definitions:

typifier	The typical physical object acting as typifier in the typification basis for physical object class membership association.
typified	The physical object class acting as typified in the typification basis for physical object class membership association.

6.5.270 unit_derivation

A type of characteristic derivation association indicating that a unit of measure, the product, is derived from an dimension, the basis.

EXPRESS specification:

```
*)
ENTITY unit_derivation
   SUBTYPE OF(characteristic_derivation);
END_ENTITY;
```

(*

6.5.271 unit_of_measure

A type of typical point that is a standardised quantity enabling quantities to be meaningfully compared.

EXPRESS specification:

```
*)
ENTITY unit_of_measure
  SUBTYPE OF(typical_point);
INVERSE
  uom_conversion_basis          :  SET OF unit_of_measure_conversion FOR
                                basis;
  uom_conversion_result         :  SET OF unit_of_measure_conversion FOR
                                result;
  quantity_value                :  SET OF quantity_info_content FOR
                                unit_of_measure;
  normal_uom_unit               :  SET OF normal_char_unit_of_measure FOR
                                unit;
END_ENTITY;
(*
```

Attribute definitions:

uom_conversion_basis	The unit of measure conversions this unit is involved with as the basis.
uom_conversion_result	The unit of measure conversions this unit of measure is involved with as the result.
quantity_value	The quantities that are defined using this unit of measure.
normal_uom_unit	The normal char unit of measure association this unit of measure is involved in as the unit.

6.5.272 unit_of_measure_conversion

A type of association defining the parameters that can be used to convert a quantity from one unit of measure, the basis, to another, the result.

EXPRESS specification:

```
*)
ENTITY unit_of_measure_conversion
  SUPERTYPE OF (ONEOF(linear_conversion, logarithmic_conversion))
  SUBTYPE OF(association);
  result                        :  unit_of_measure;
  basis                         :  unit_of_measure;
END_ENTITY;
(*
```

Attribute definitions:

result	The unit of measure of the result of the quantity conversion.
basis	The unit of measure of the quantity being converted.

6.5.273 usage_of_spec_fac_in_connection

A type of association between specific facility connection and specific facility indicating that a specific facility is used to make the connection.

EXPRESS specification:

```
*)
ENTITY usage_of_spec_fac_in_connection
  SUBTYPE OF(association);
  user                          :  specific_facility_connection;
  used                          :  specific_facility;
END_ENTITY;
(*
```

Attribute definitions:

user	The specific facility connection acting as the user in the usage of specific facility in connection association.
used	The specific facility that acts as the used in the usage of specific facility in connection association.

6.5.274 usage_of_spec_pob_in_connection

A type of association between specific physical object and specific physical object connection indicating that the specific physical object is used to make the connection.

EXPRESS specification:

```
*)
ENTITY usage_of_spec_pob_in_connection
   SUBTYPE OF(association);
   user                          :  specific_physical_obj_connection;
   used                          :  specific_physical_object;
END_ENTITY;
(*
```

Attribute definitions:

user	The specific physical object connection acting as the user in the usage of specific physical object in connection association.
used	The specific physical object acting as the used in the usage of specific physical object in connection association.

6.5.275 usage_of_typ_fac_in_connection

A type of association between typical facility connection and typical facility indicating that a typical facility is used to make the connection.

EXPRESS specification:

```
*)
ENTITY usage_of_typ_fac_in_connection
   SUBTYPE OF(association);
   user                          :  typical_facility_connection;
   used                          :  typical_facility;
END_ENTITY;
(*
```

Attribute definitions:

user	The typical facility connection acting as user in the usage of typical facility in connection association.
used	The typical facility connection that acts as the user in the usage of typical facility in connection association.

6.5.276 usage_of_typ_pob_in_connection

A type of association between typical physical object and typical physical object connection that indicates that the typical physical object is used to make the connection.

EXPRESS specification:

```
*)
ENTITY usage_of_typ_pob_in_connection
   SUBTYPE OF(association);
   user                          :  typical_physical_obj_connection;
   used                          :  typical_physical_object;
END_ENTITY;
```

```
(*
```

Attribute definitions:

user	The typical physical object connection association acting as user in the usage of typical physical object in connection association.
used	The typical physical object acting as the used in the usage of typical physical object in connection association.

6.5.277 version

A type of association indicating that two things are considered as being similar. The extend and degree of the similarity is not defined. The association is symmetric and non transitive. Version and derivation are distinct. A version and a derivation may result from the same creating activity.

EXPRESS specification:

```
*)
ENTITY version
   ABSTRACT SUPERTYPE OF (ONEOF(specific_physical_obj_version, spe-
                                cific_facility_version, spe-
                                cific_service_version, typi-
                                cal_physical_obj_version, spe-
                                cific_info_content_version, spe-
                                cific_activity_version, typi-
                                cal_activity_version, typi-
                                cal_facility_version, typi-
                                cal_info_content_version, typi-
                                cal_service_version))
   SUBTYPE OF(association);
END_ENTITY;
(*
END_SCHEMA;
(*
```

Annex A
(normative)

Information object registration

To provide for unambiguous identification of an information object in an open system, the object identifier

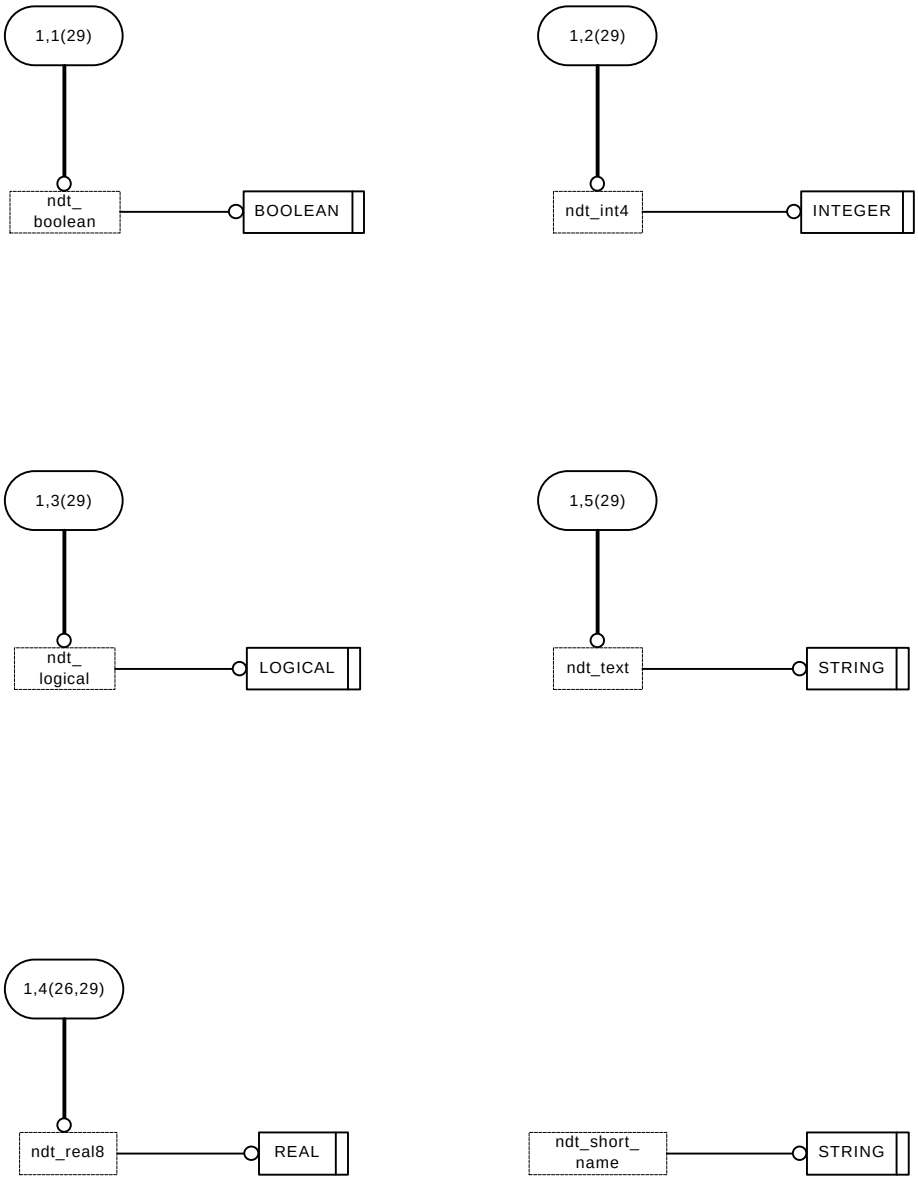
{iso standard 15926 part{2} version {1}}

is assigned to this part of ISO 15926. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 15926-1.

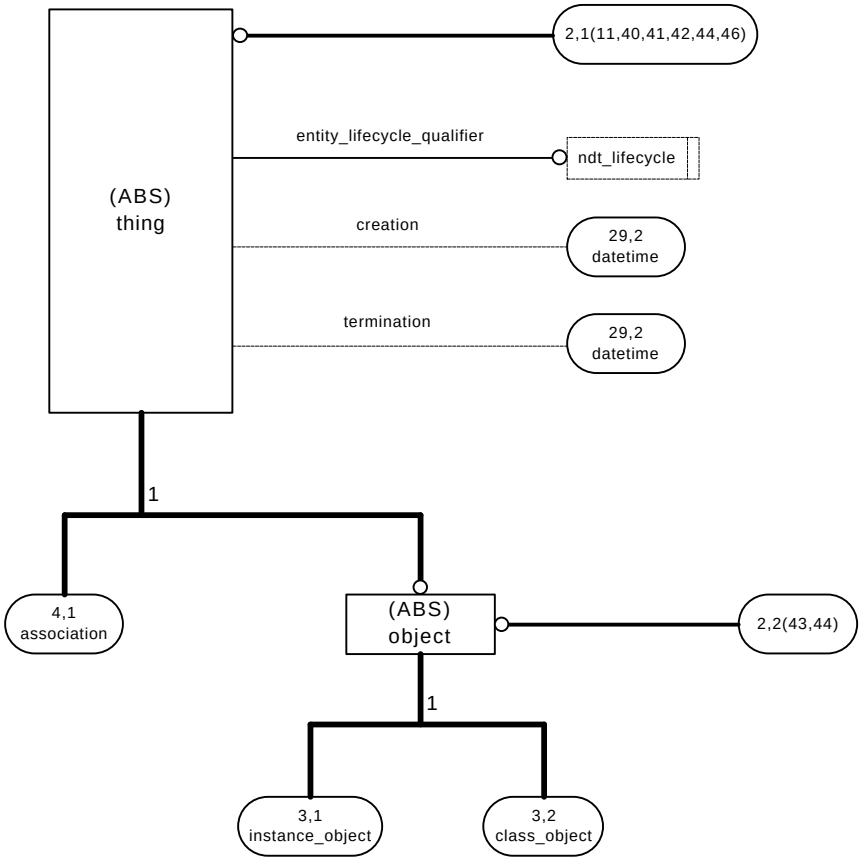
Annex B
(informative)

EXPRESS G Diagrams

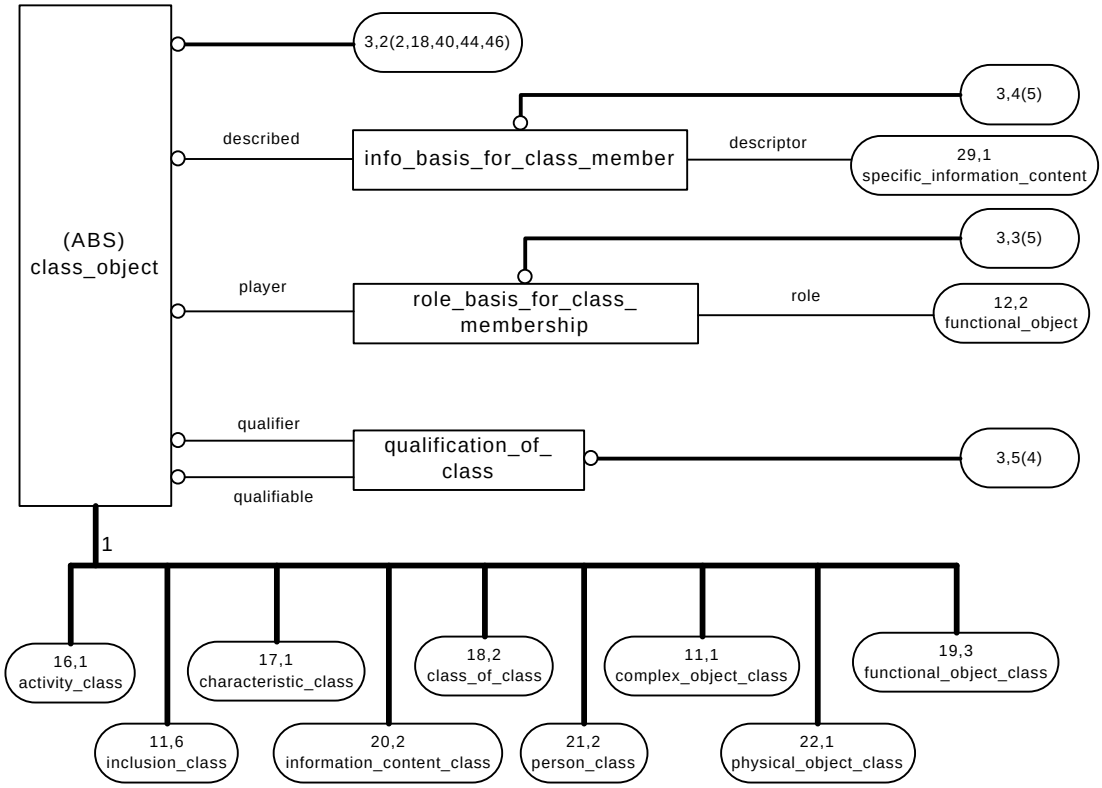
The data model is shown using 51 EXPRESS G diagrams. For clarity all the names of the inverse attributes of the model have been omitted from the diagrams.

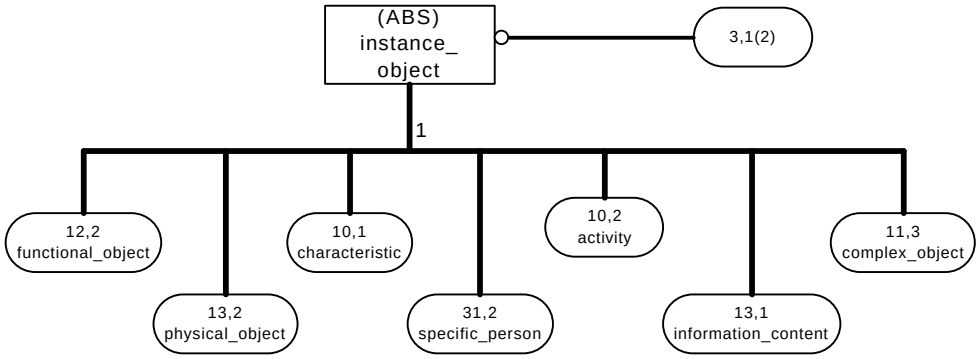


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 1. of 51

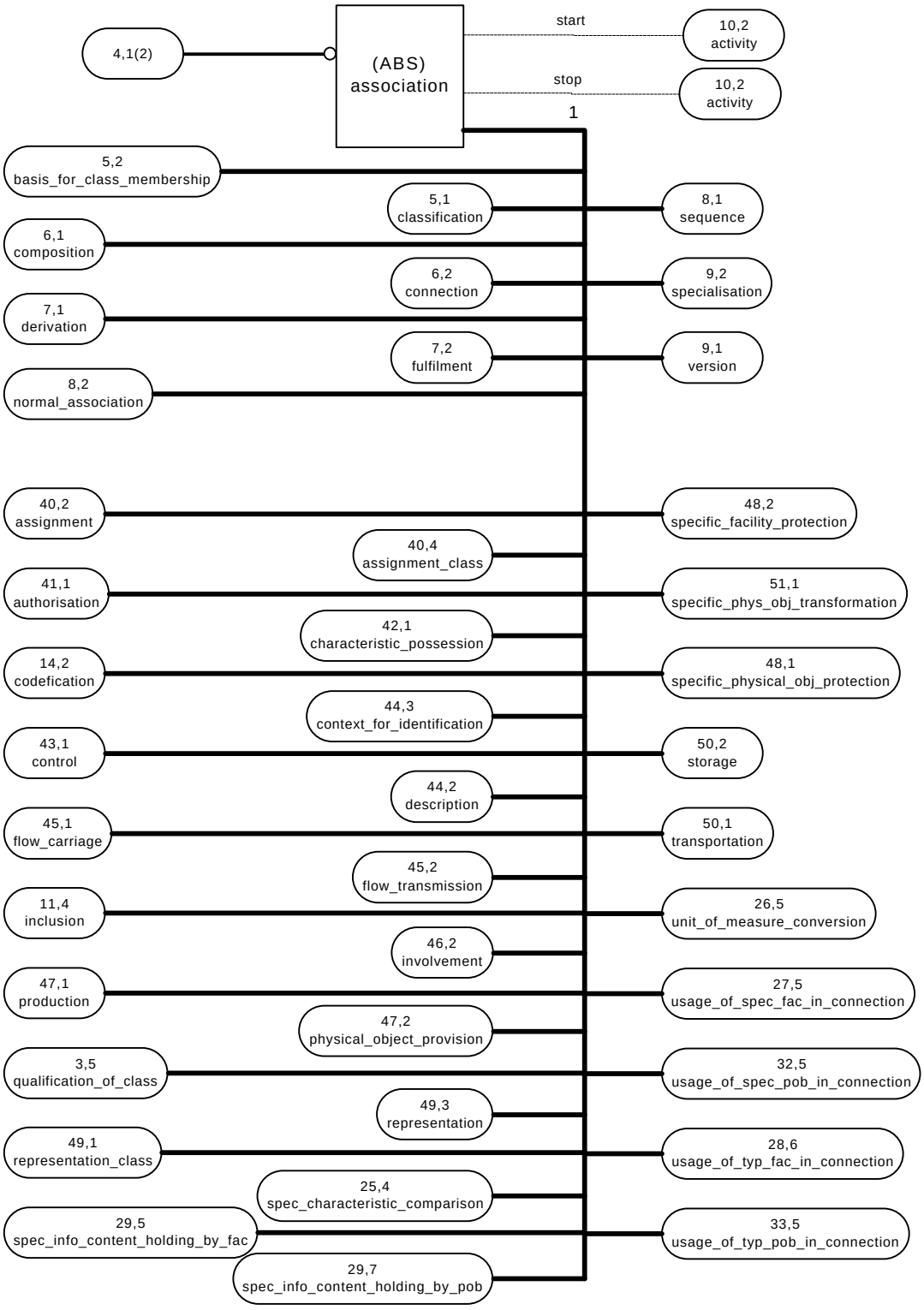


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 2. of 51

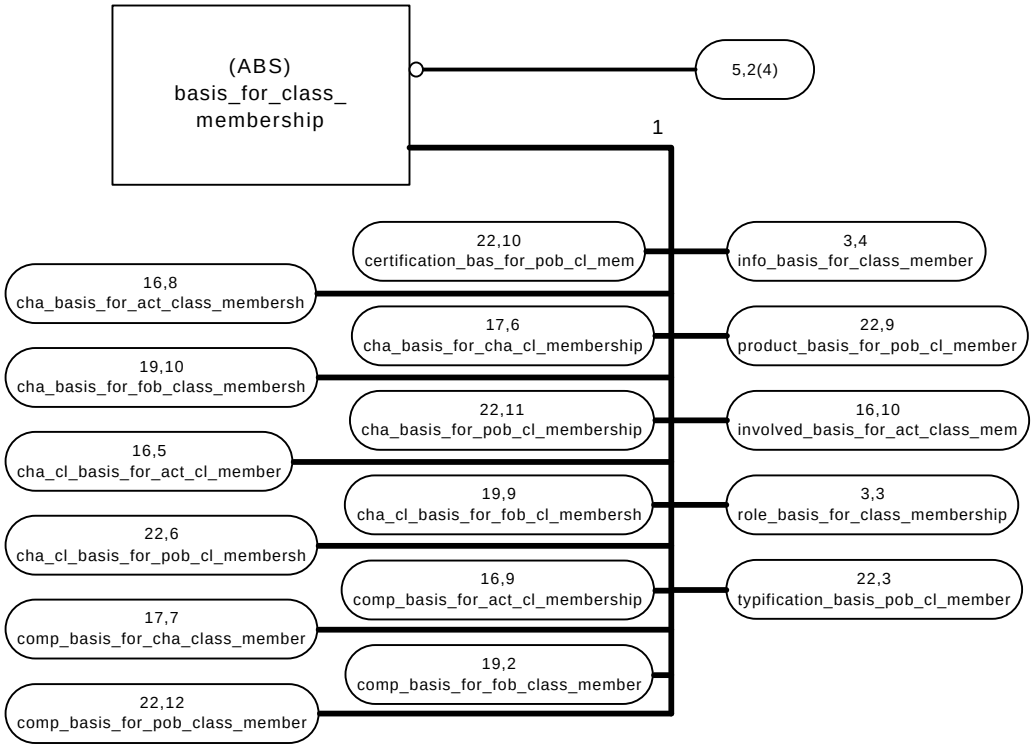


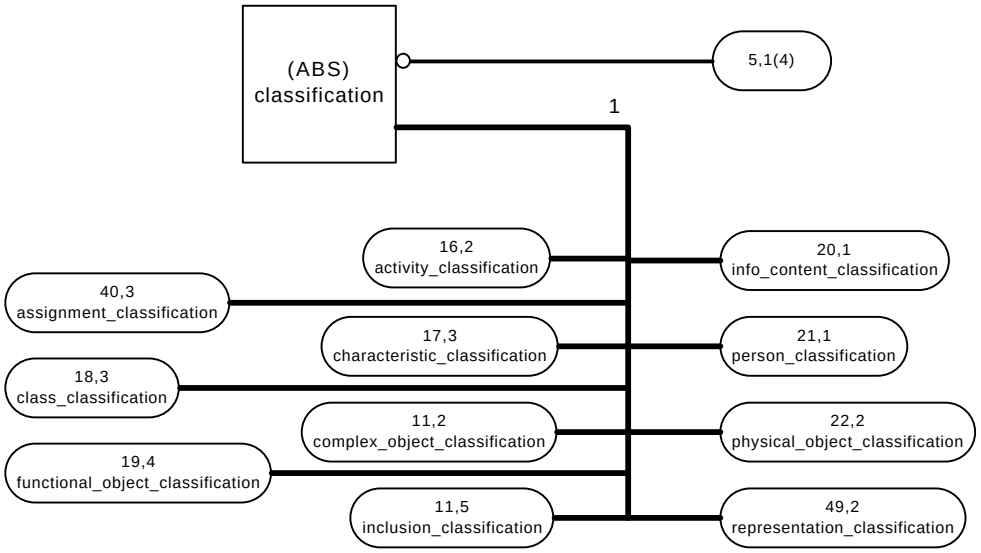


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 3. of 51

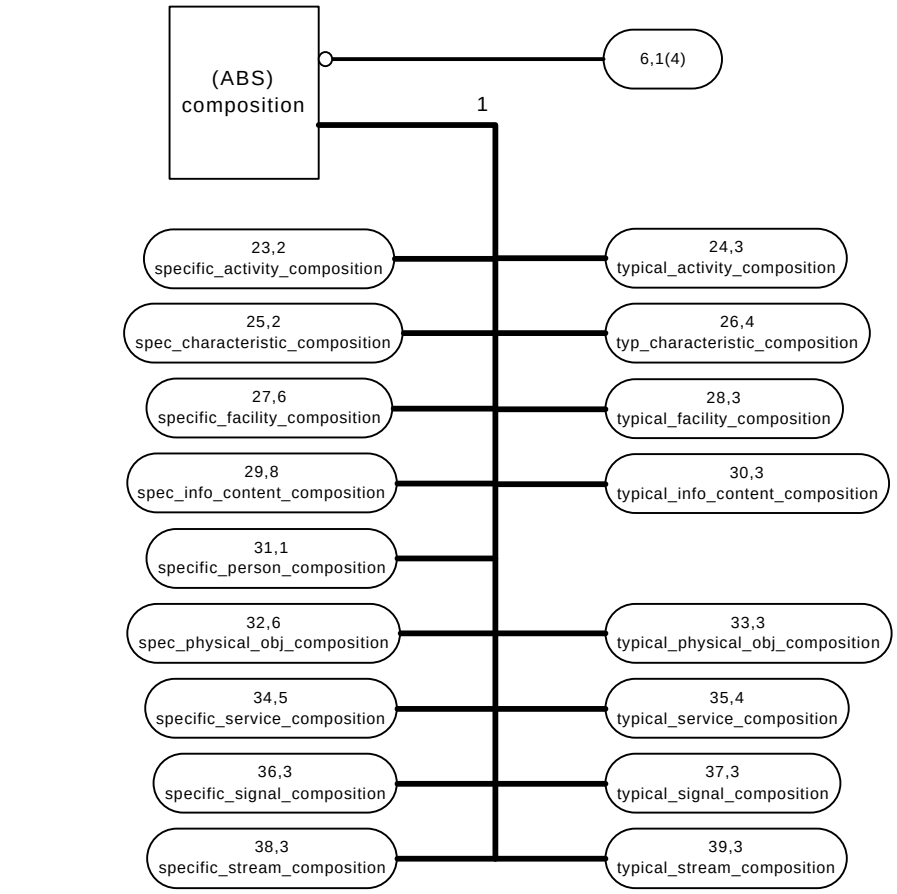


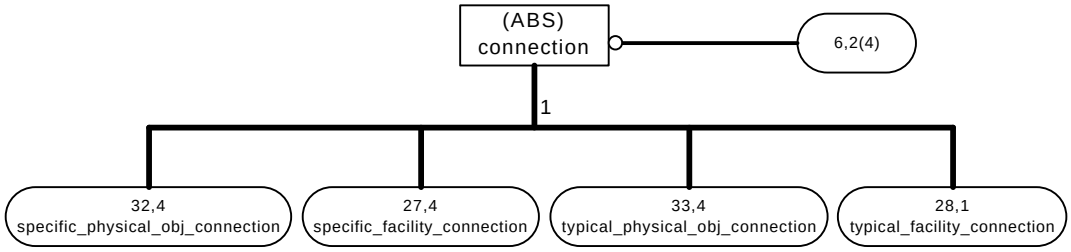
Complete entity level diagram of the oil_and_gas_production_facilities schema Page 4. of 51



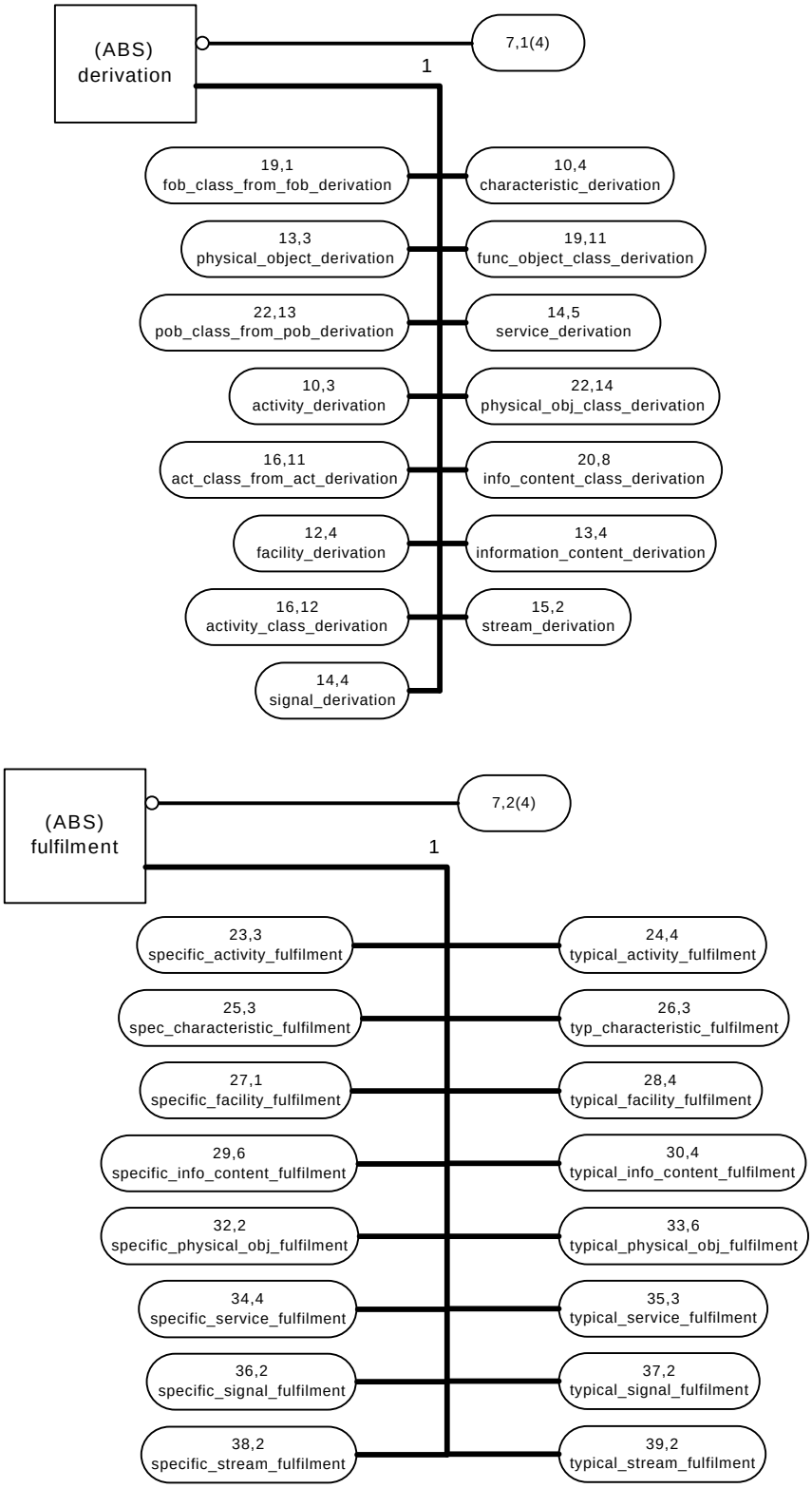


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 5. of 51

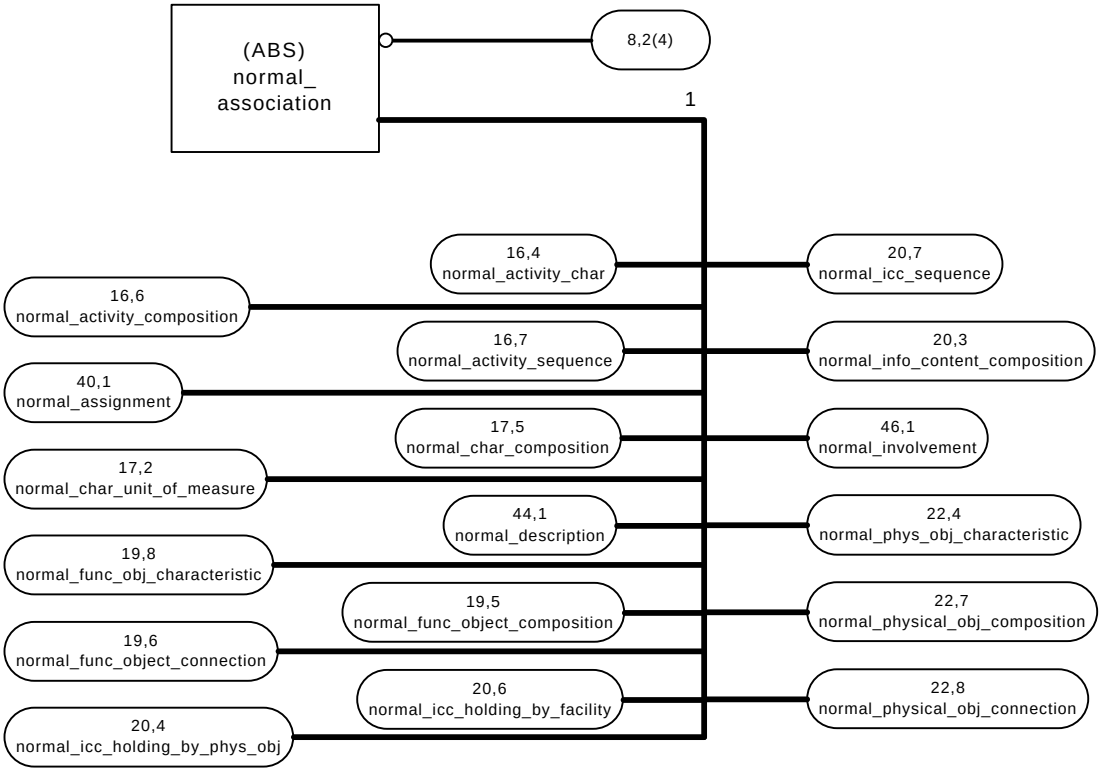


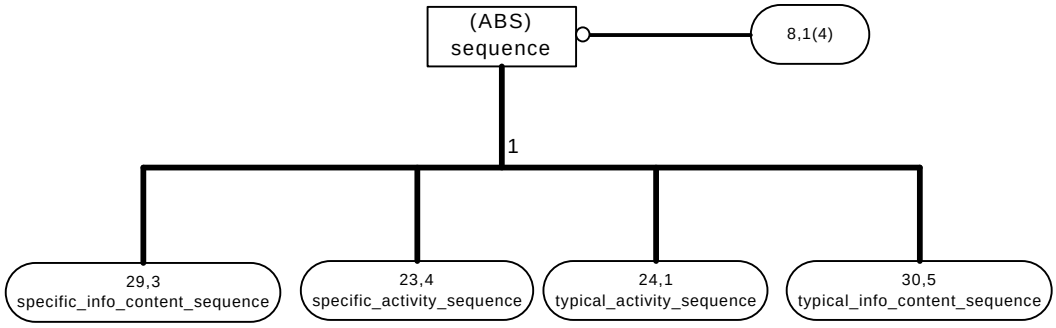


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 6. of 51

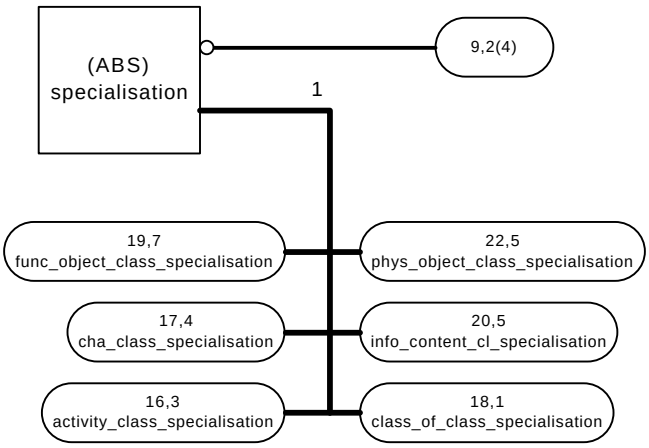


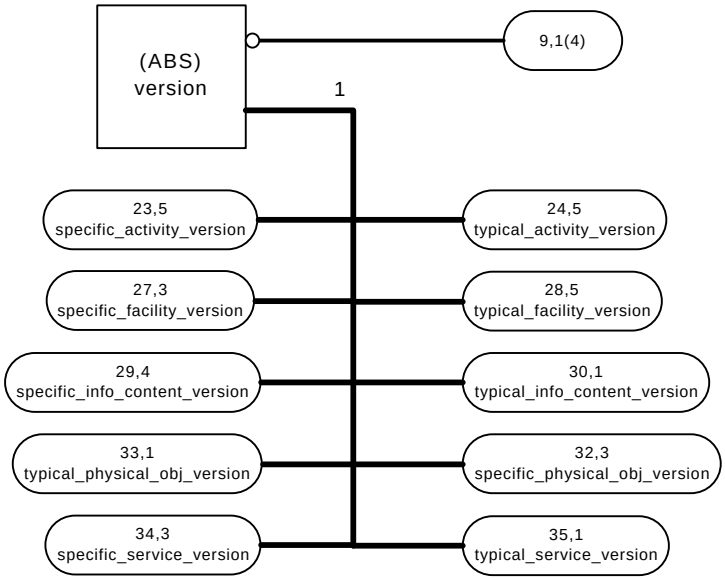
Complete entity level diagram of the oil_and_gas_production_facilities schema Page 7. of 51



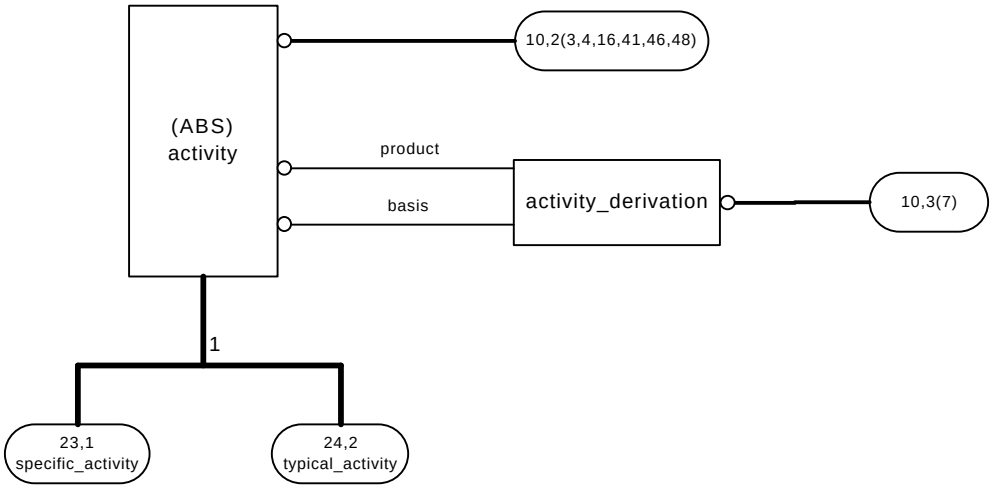


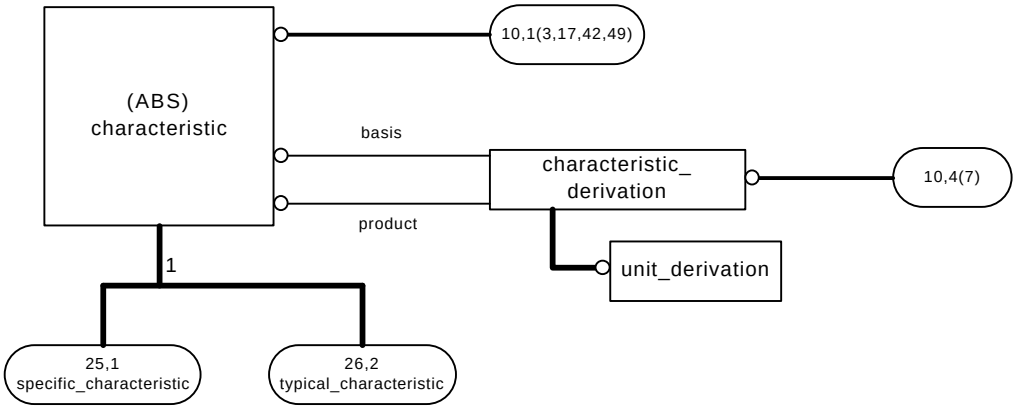
Complete entity level diagram of the oil_and_gas_production_facilities schema Page 8. of 51



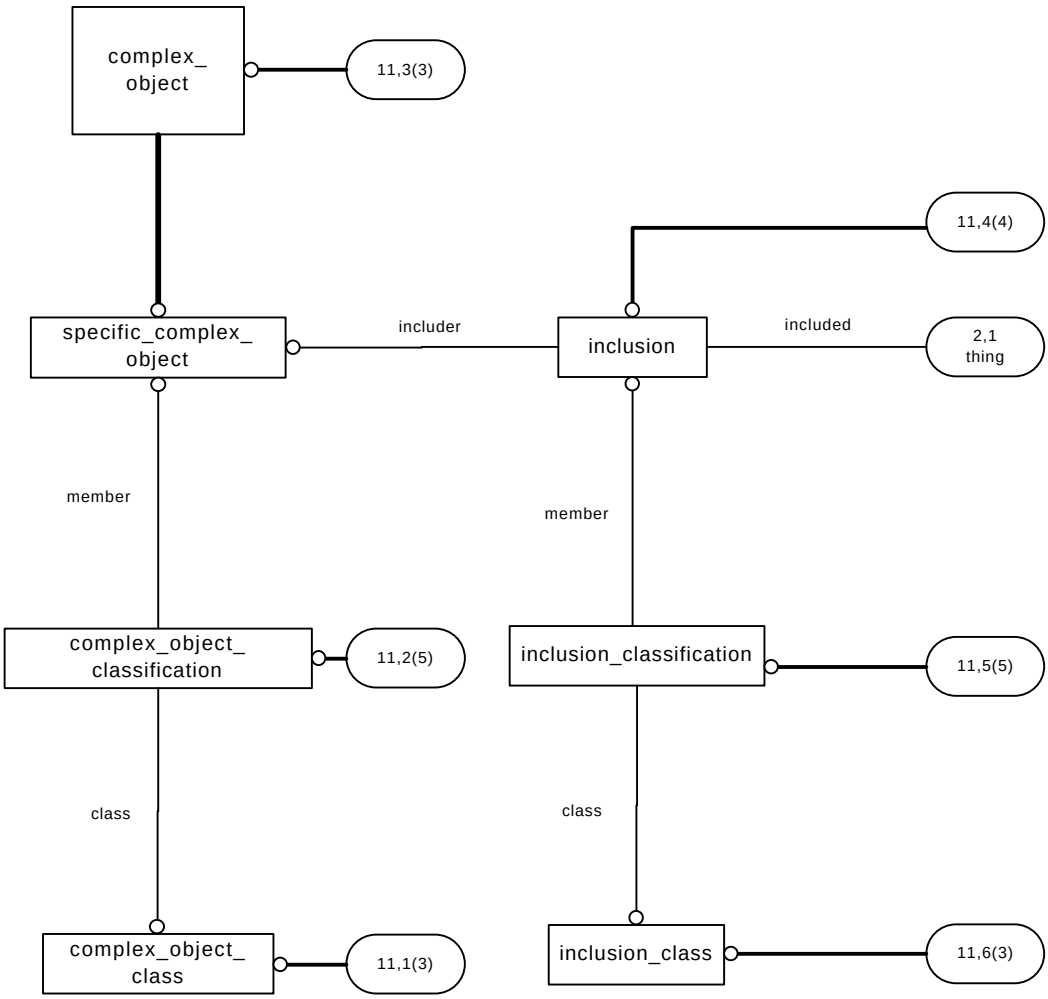


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 9. of 51

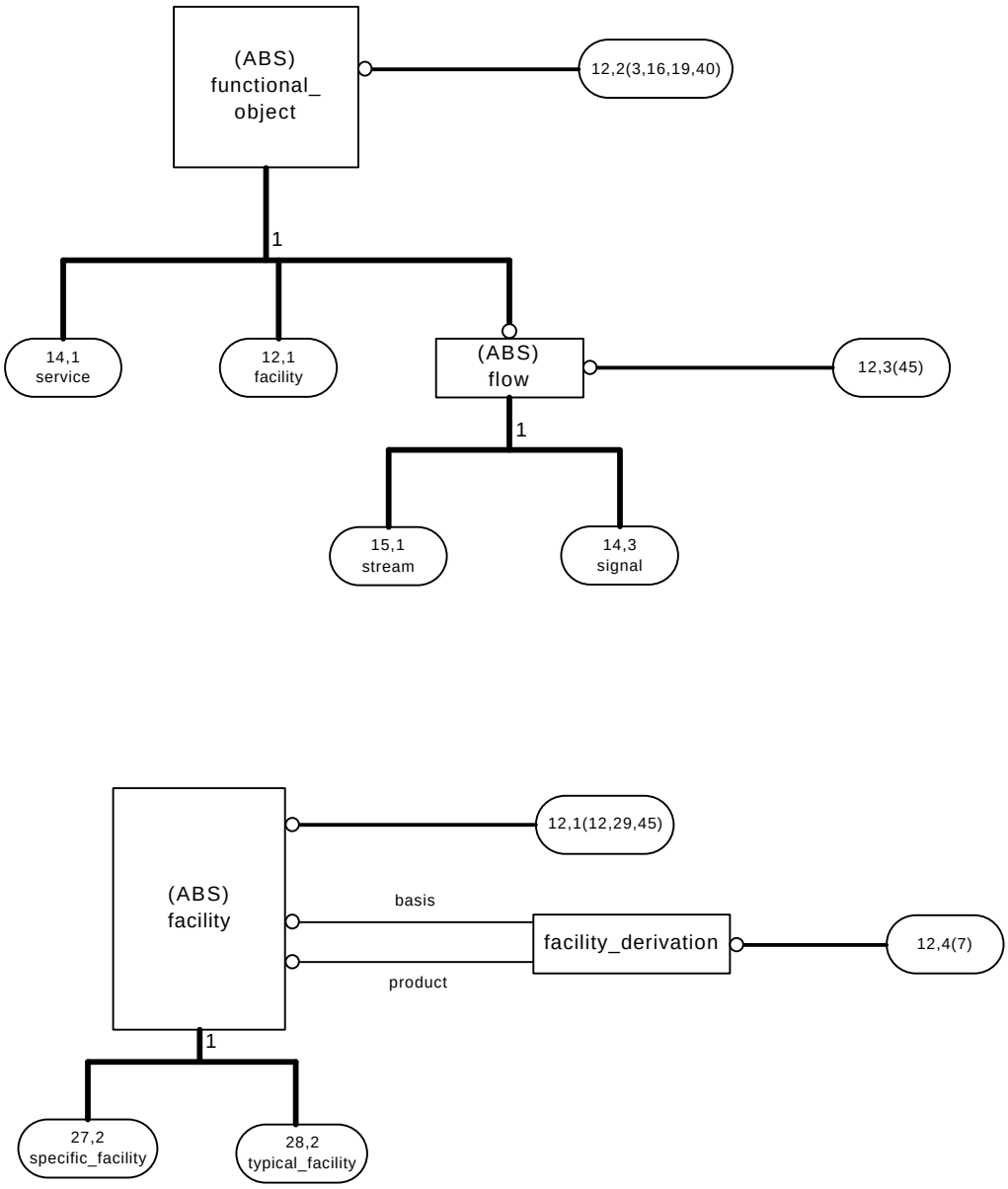




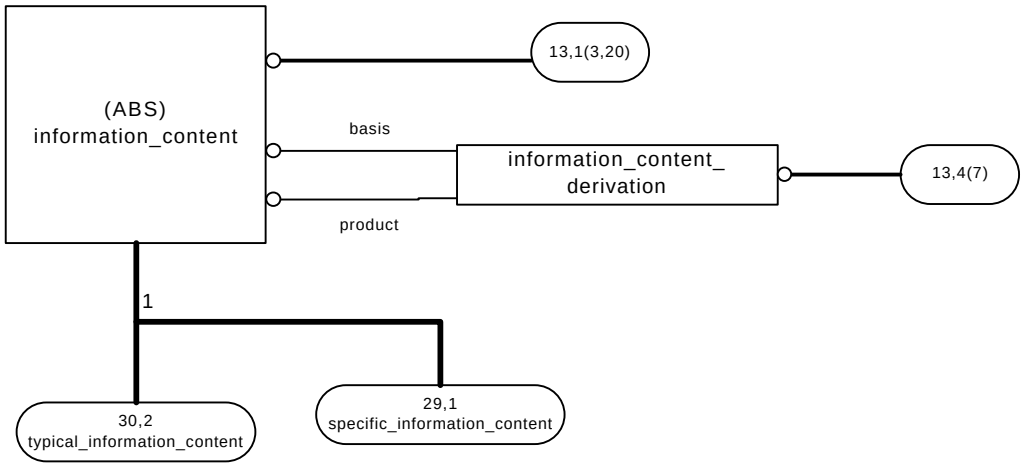
Complete entity level diagram of the oil_and_gas_production_facilities schema Page 10. of 51

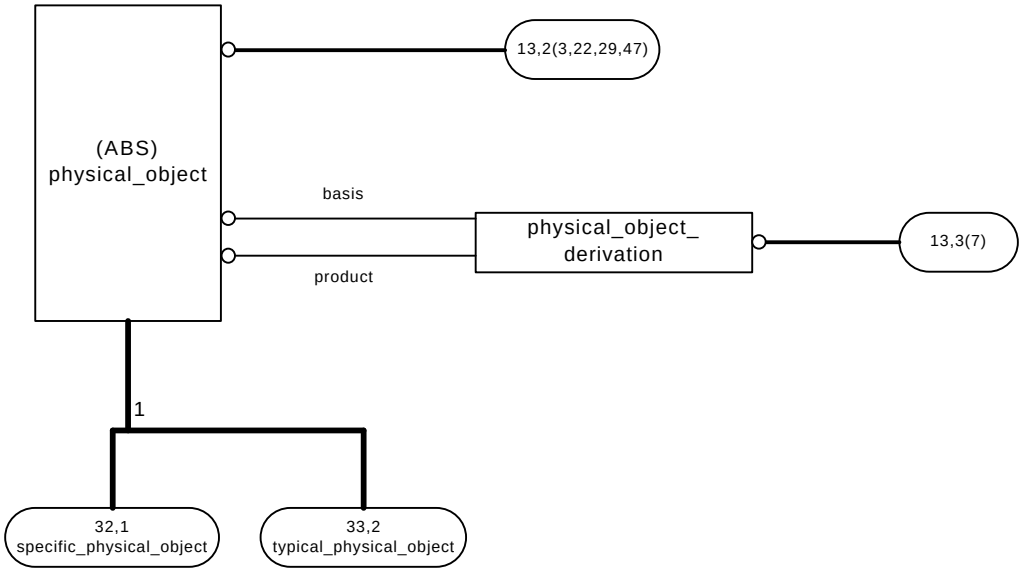


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 11. of 51

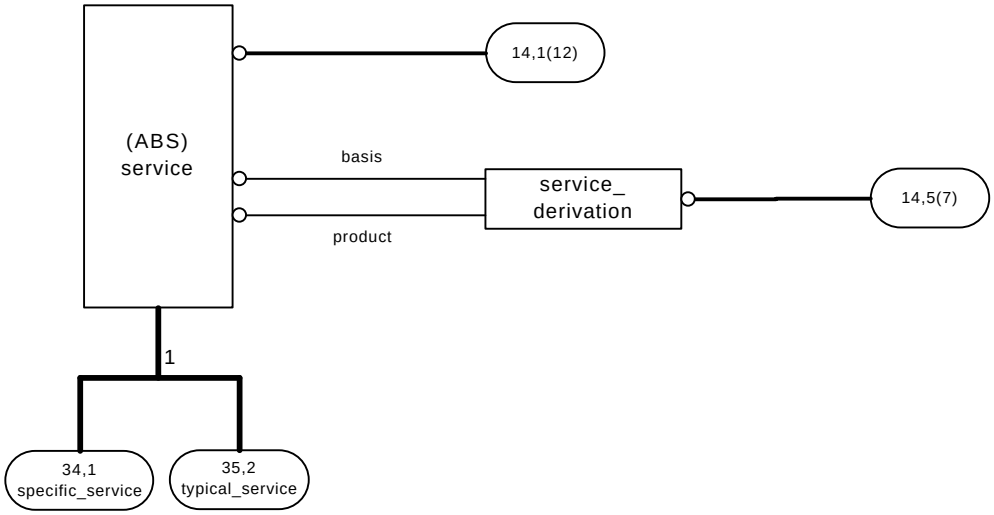


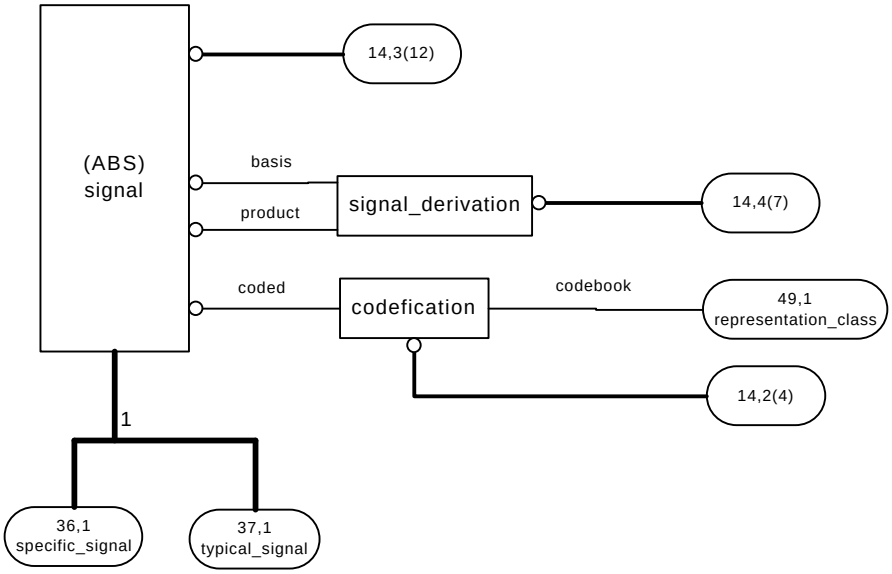
Complete entity level diagram of the oil_and_gas_production_facilities schema Page 12. of 51





Complete entity level diagram of the oil_and_gas_production_facilities schema Page 13. of 51





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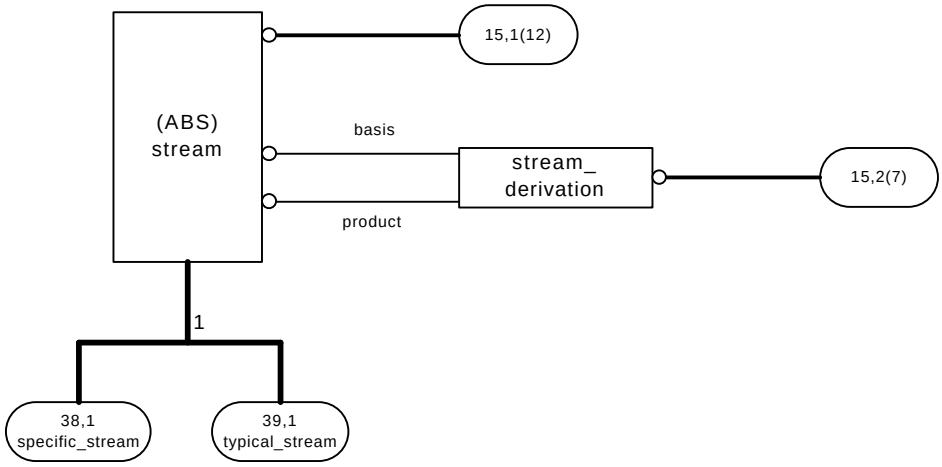

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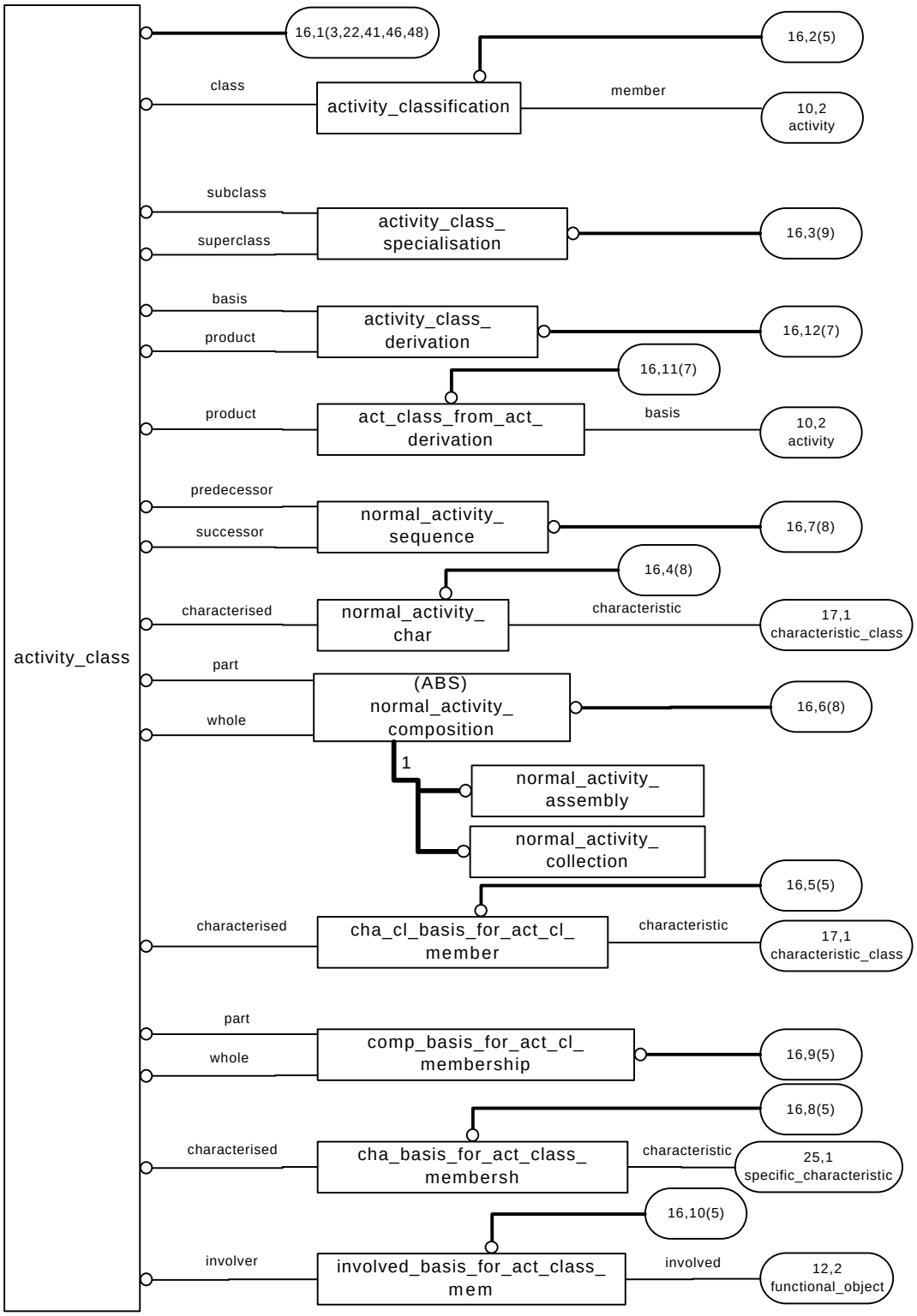

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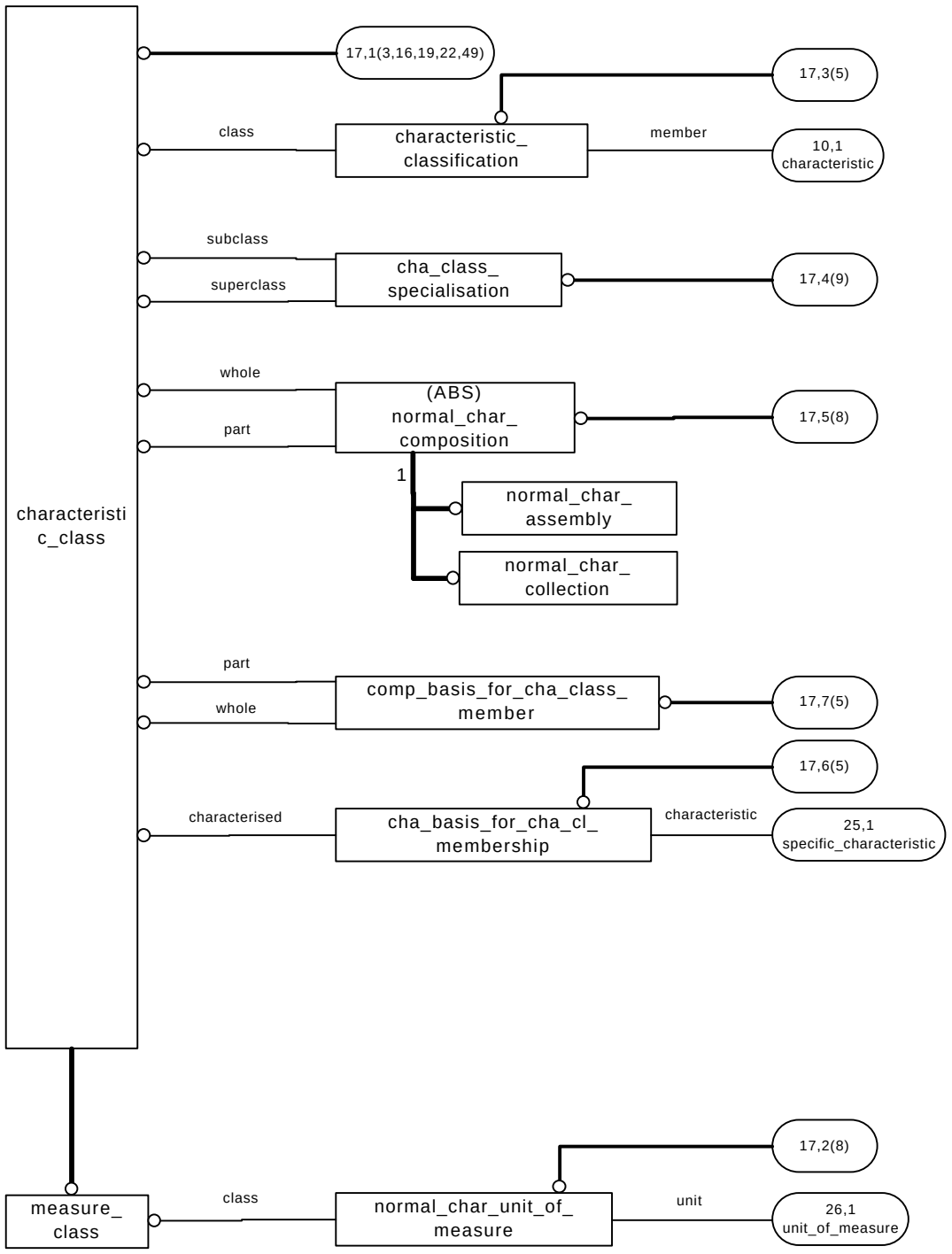

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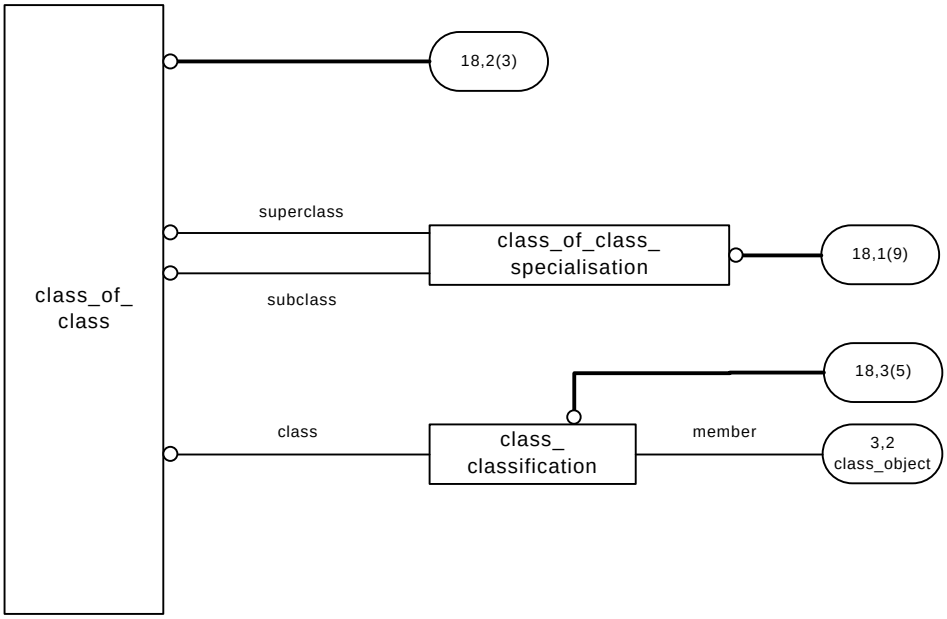

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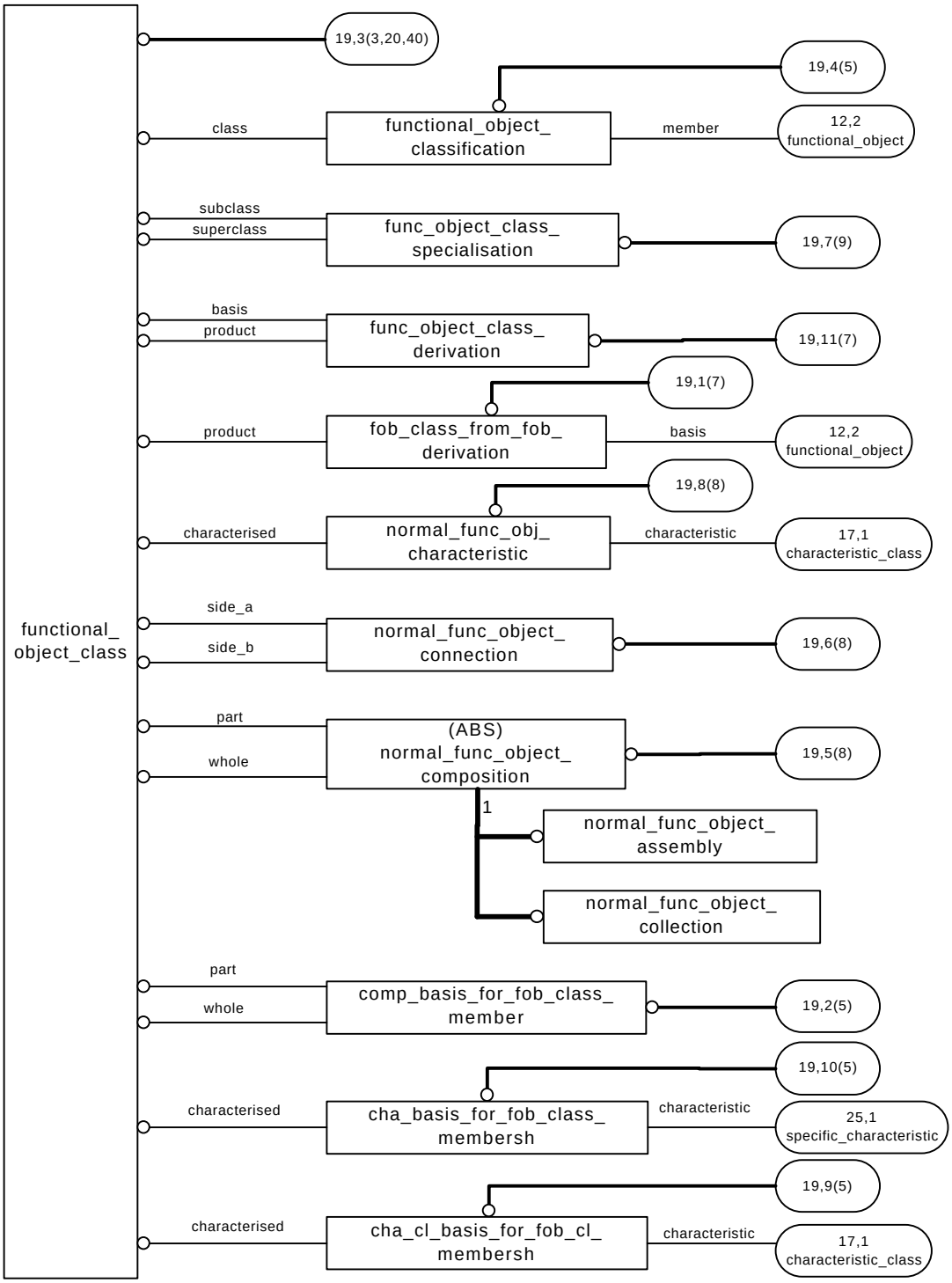

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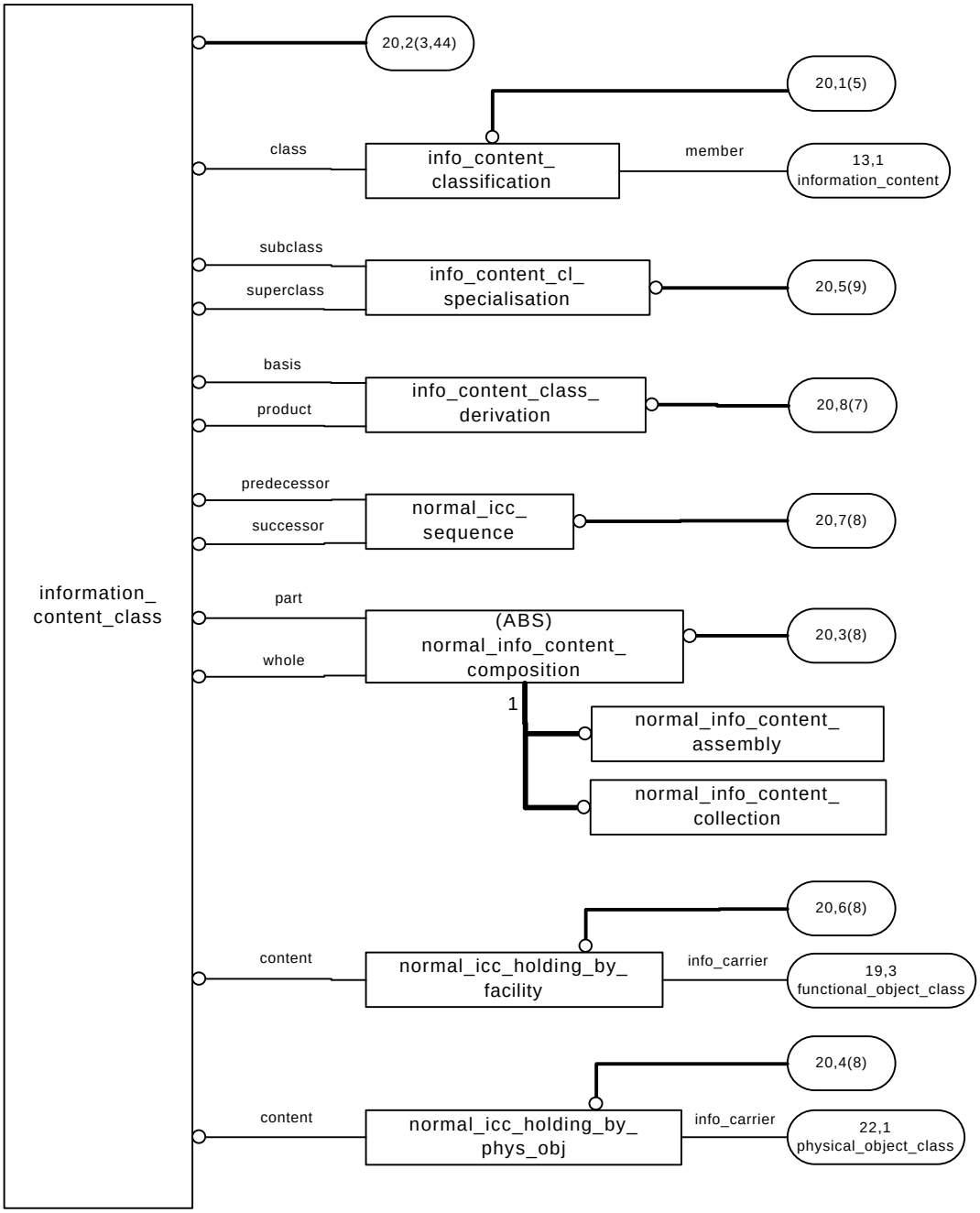

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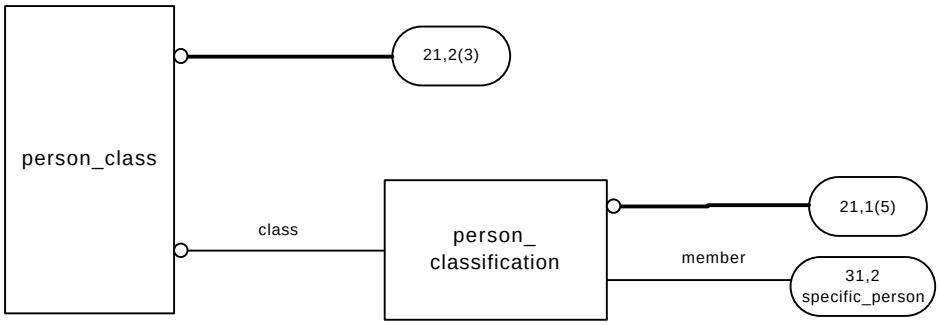

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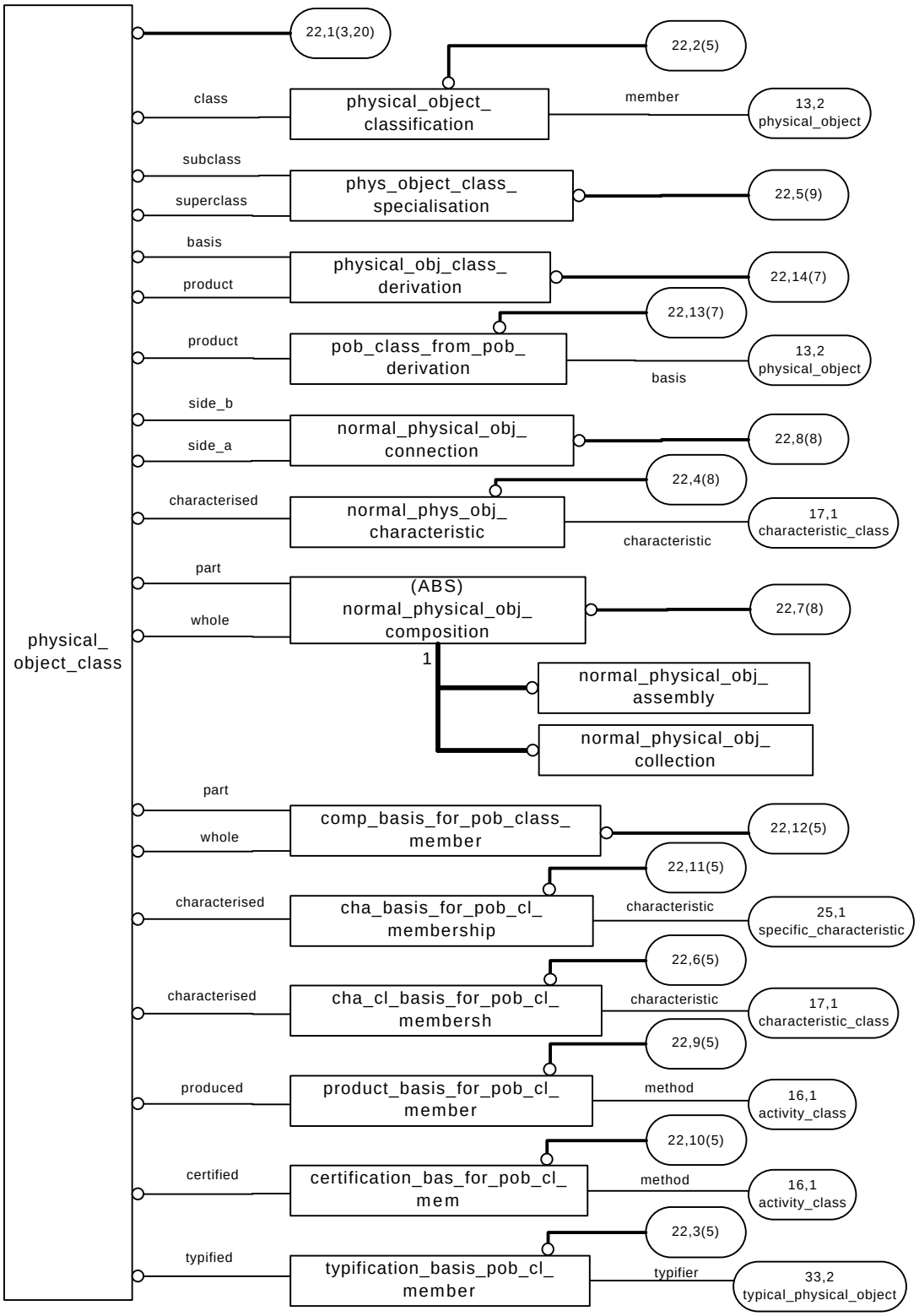

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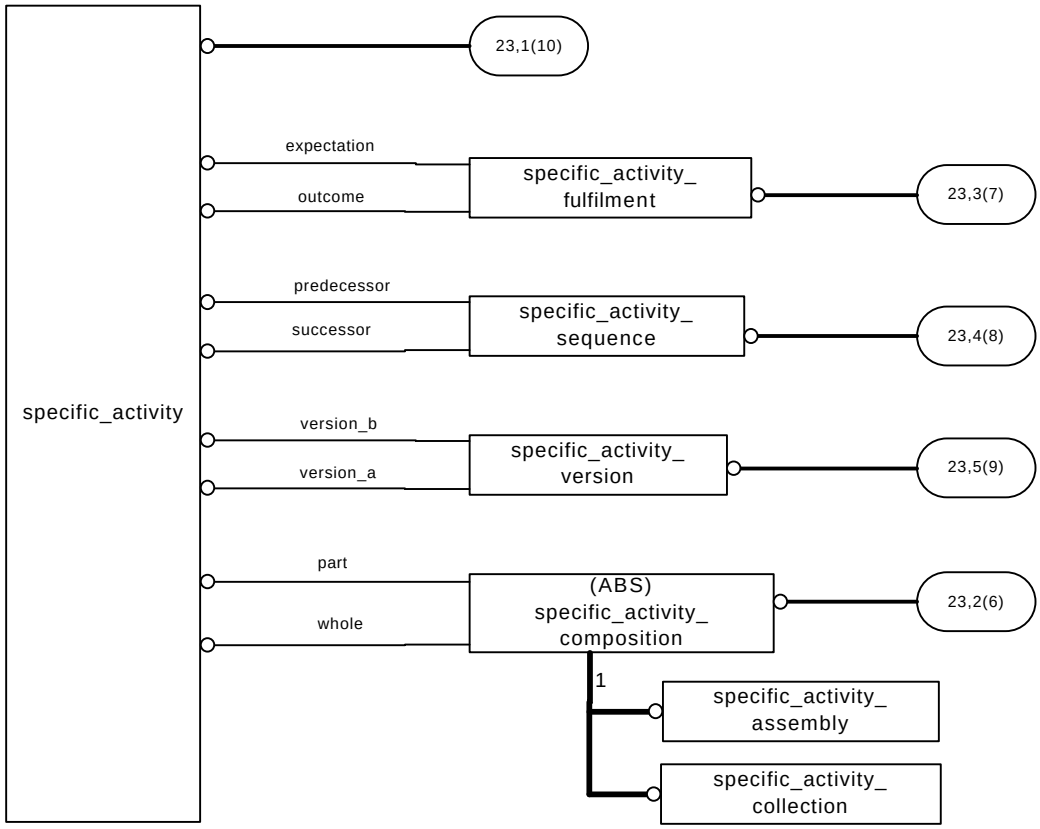

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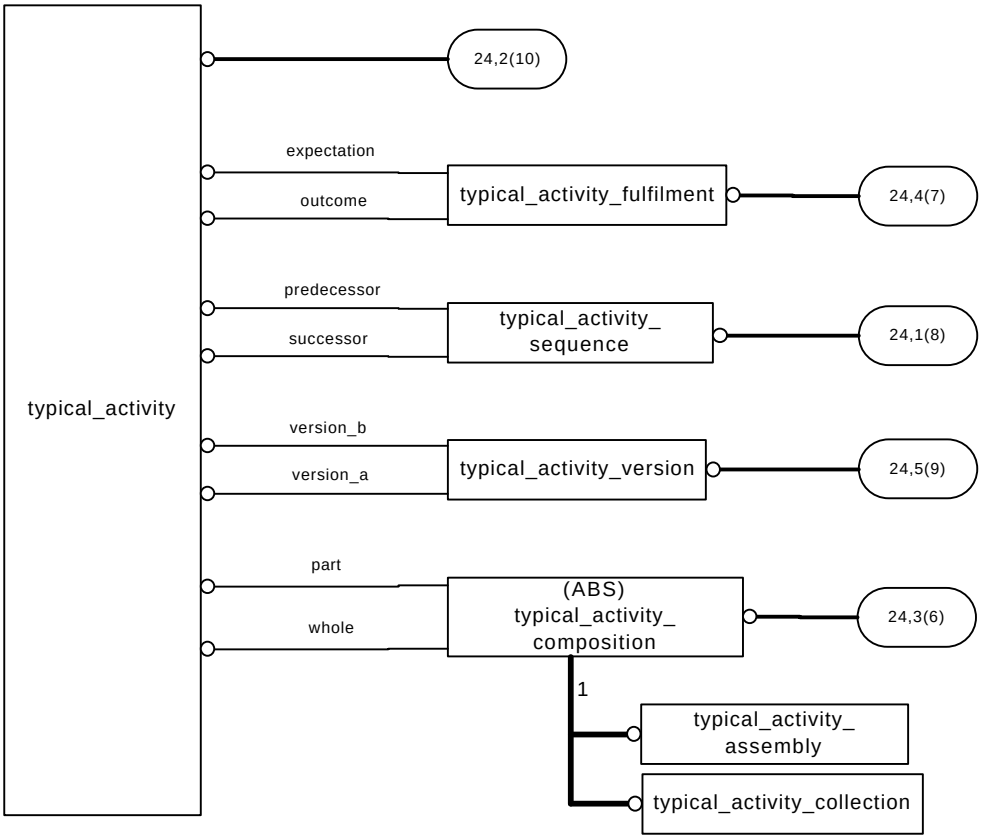

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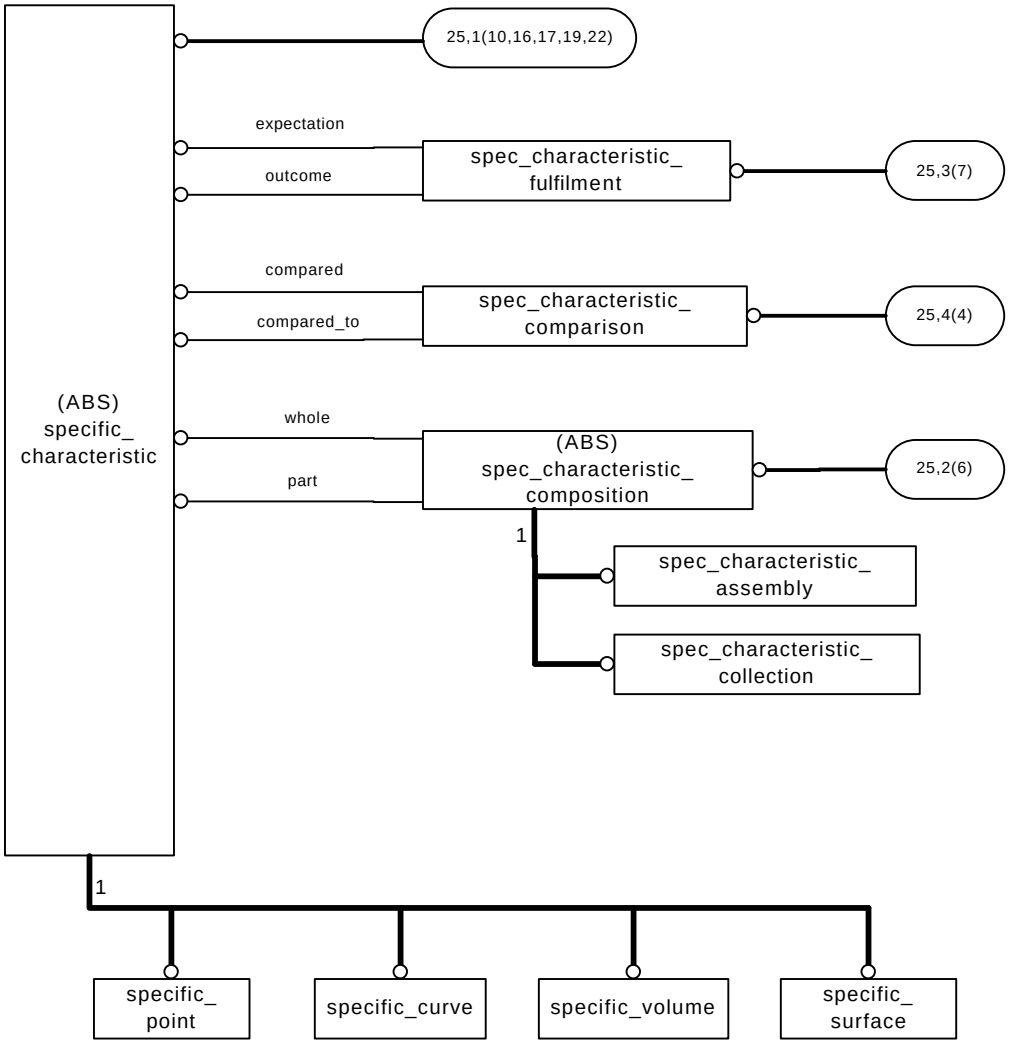

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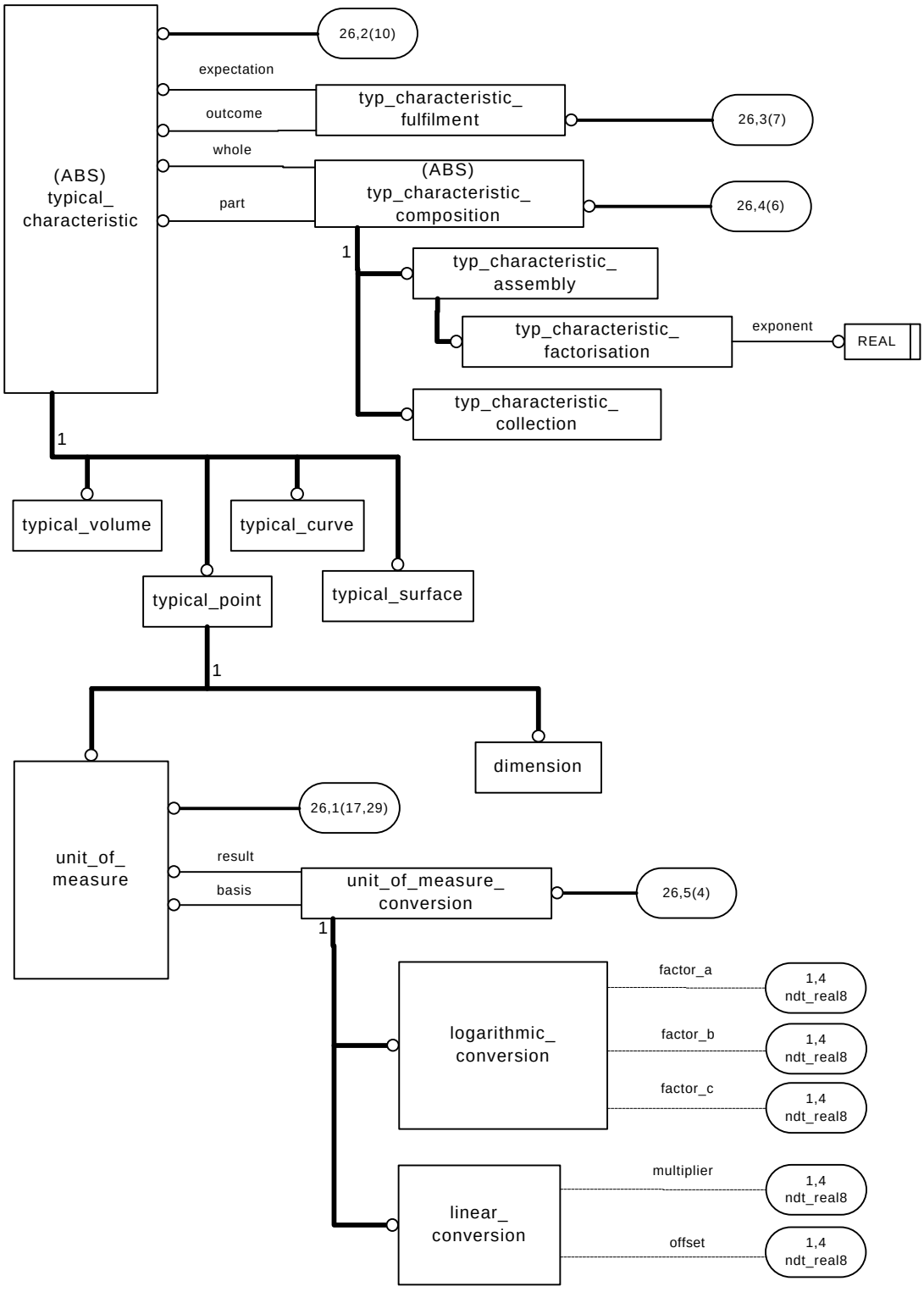

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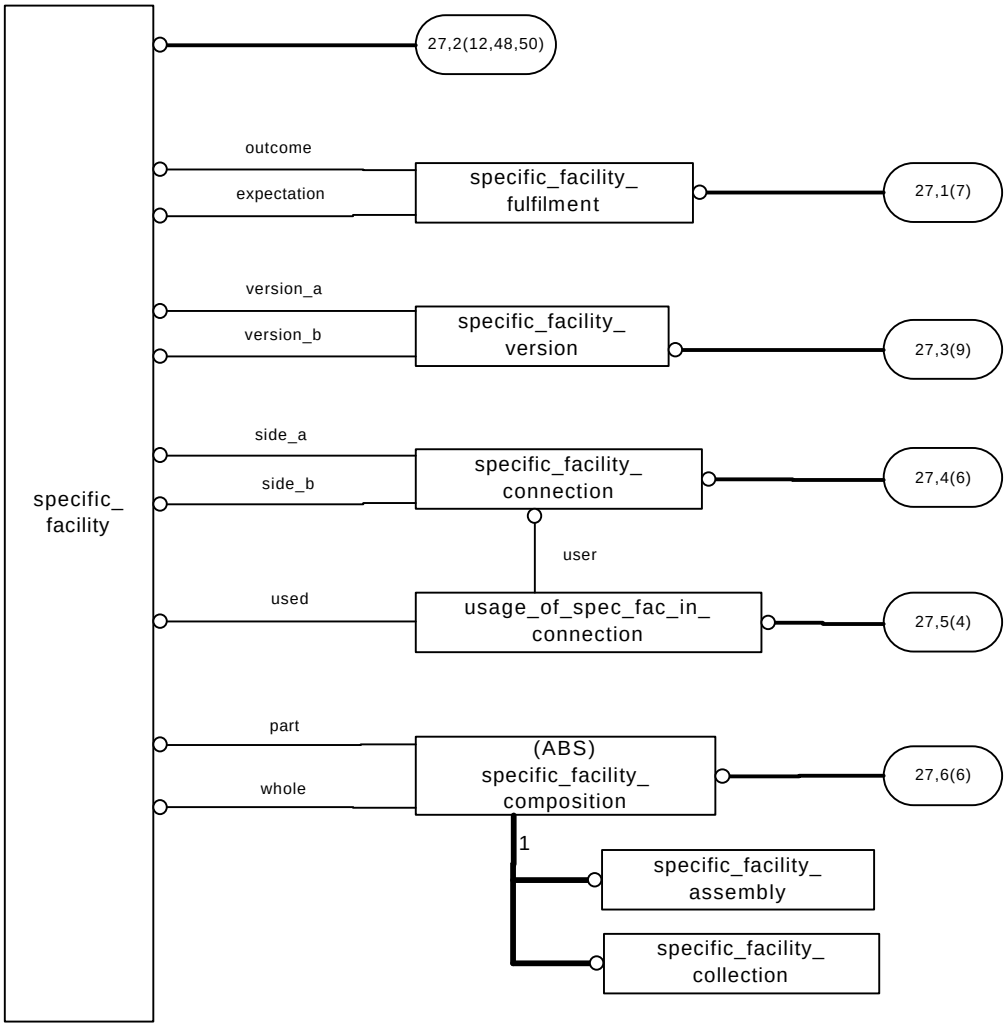

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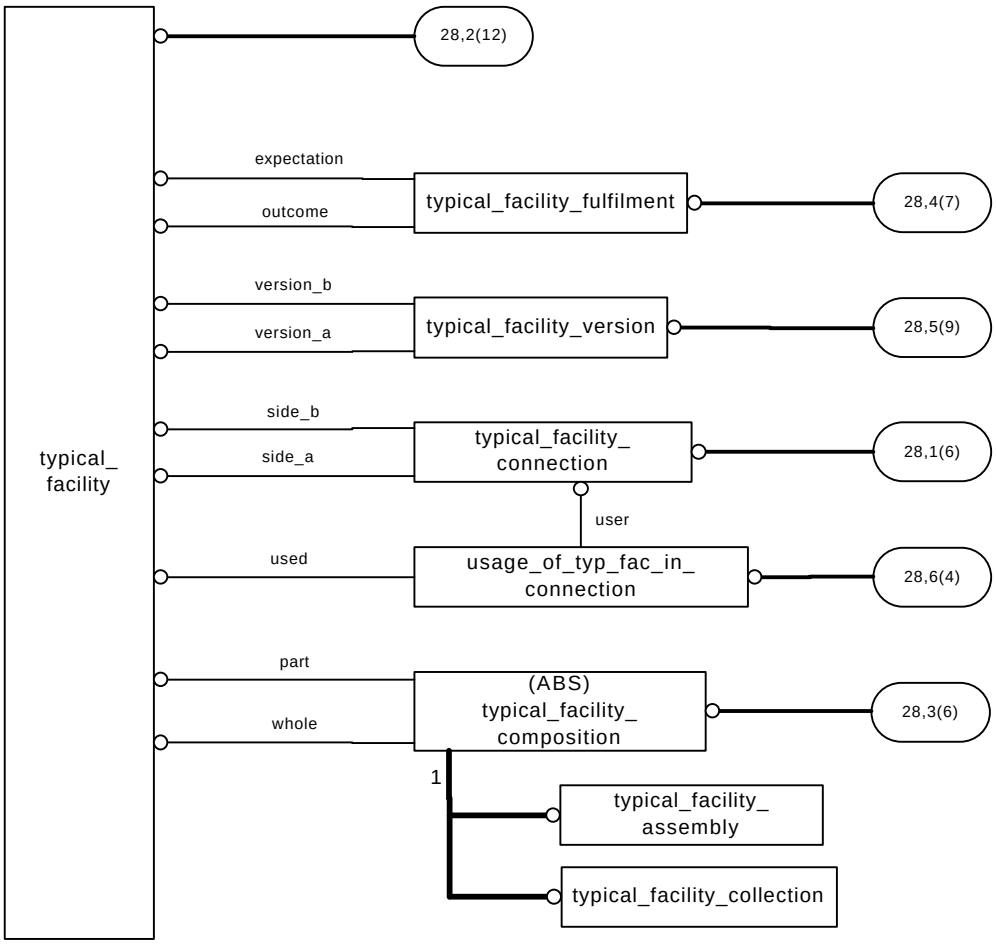

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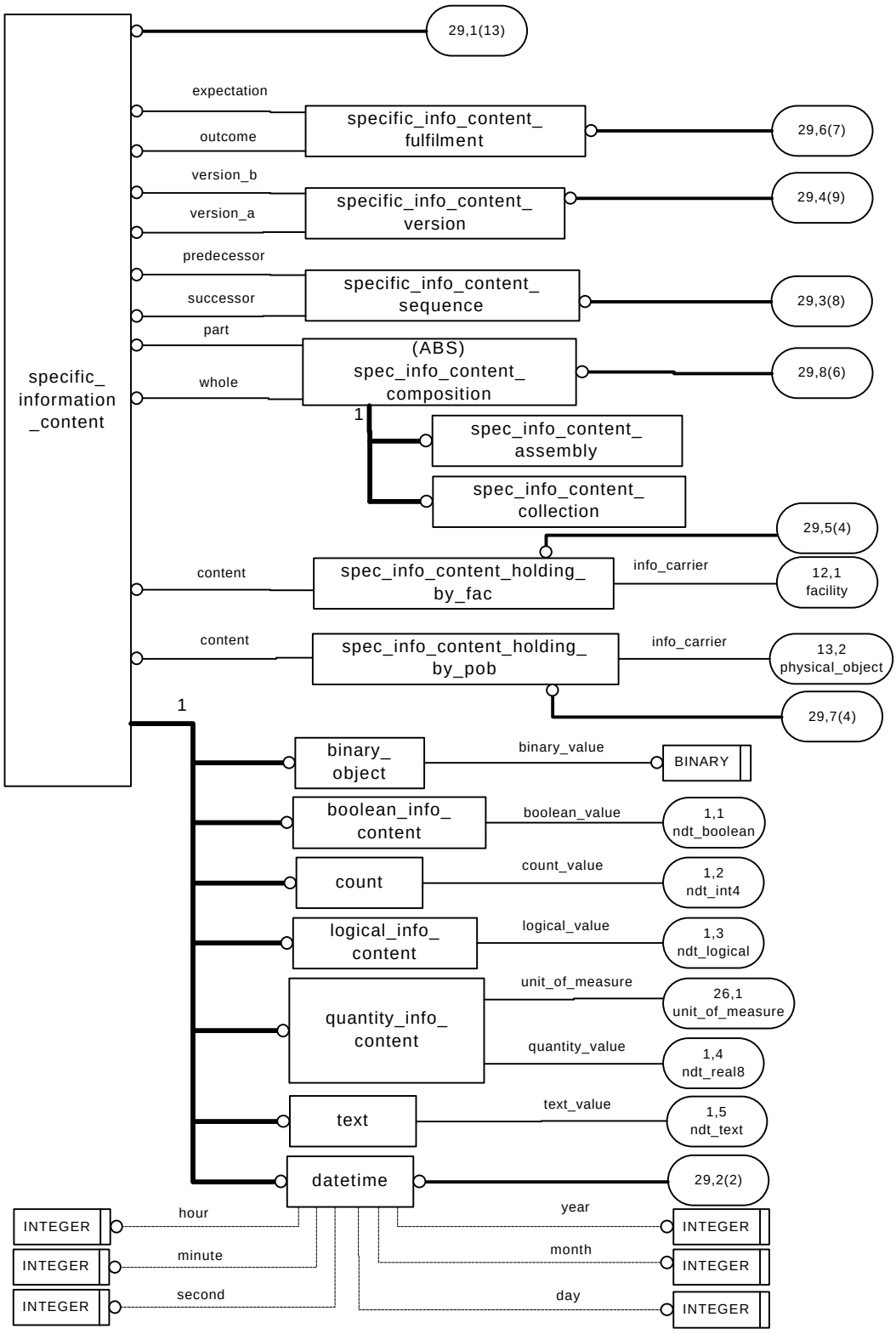

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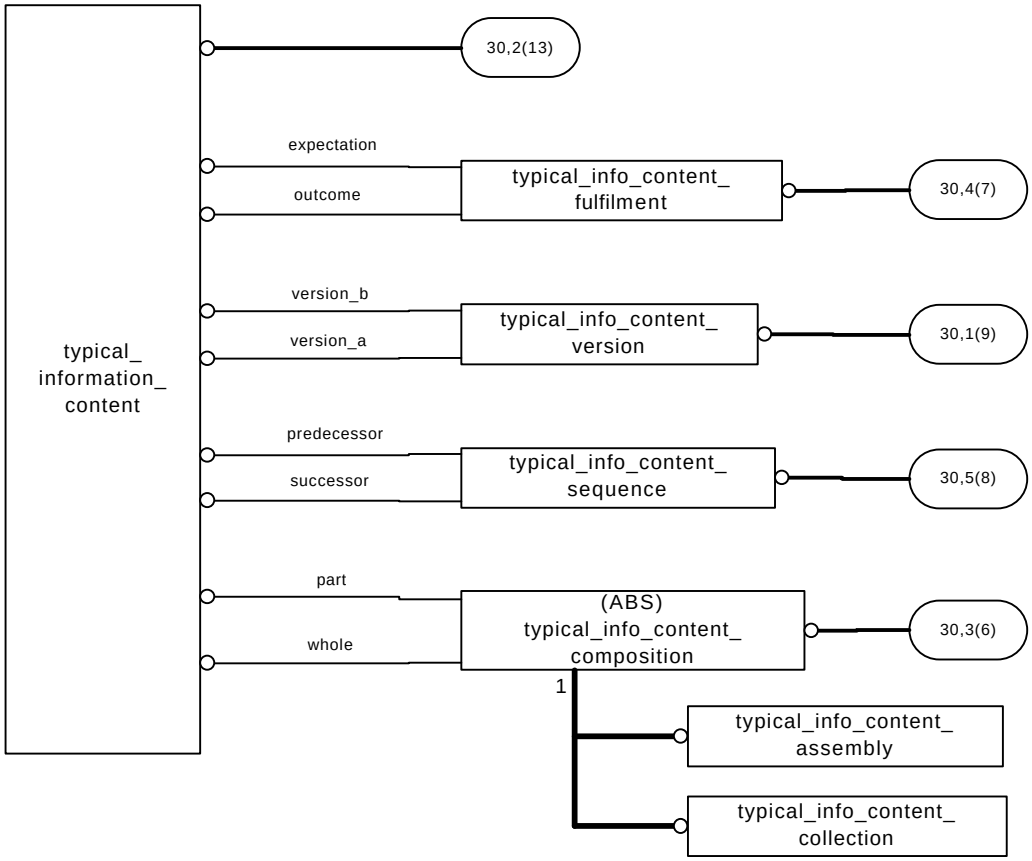

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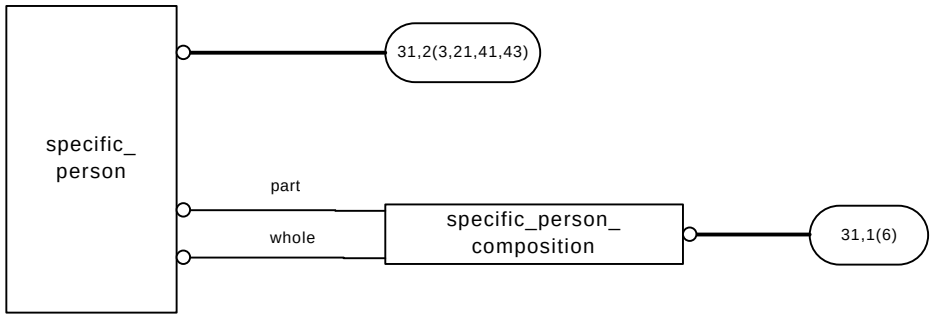

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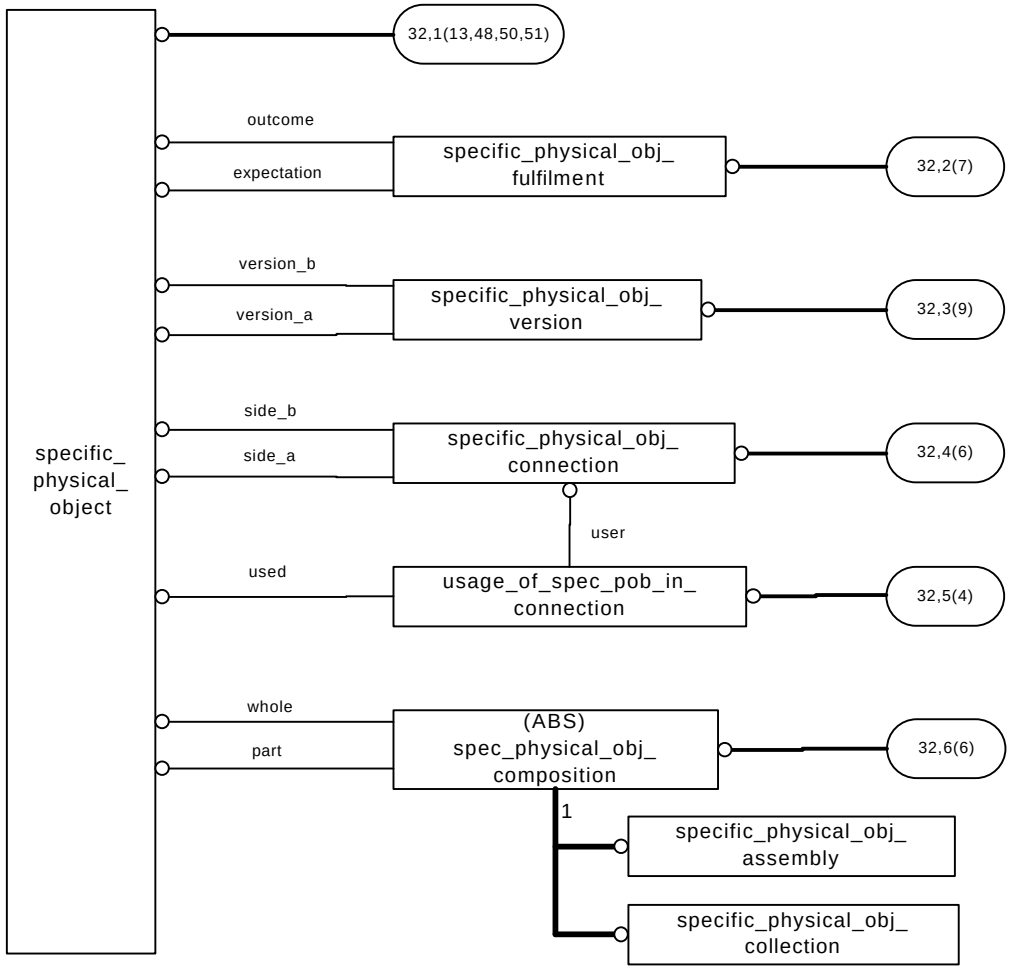

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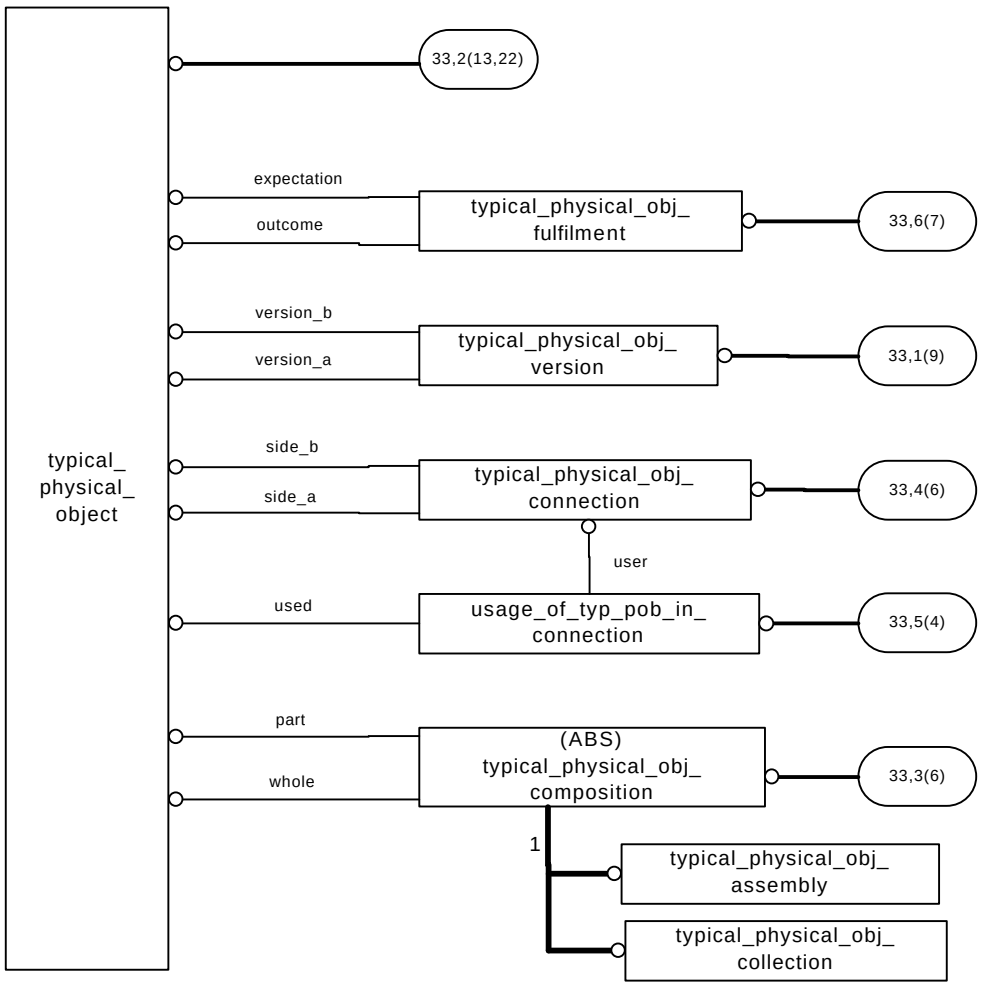

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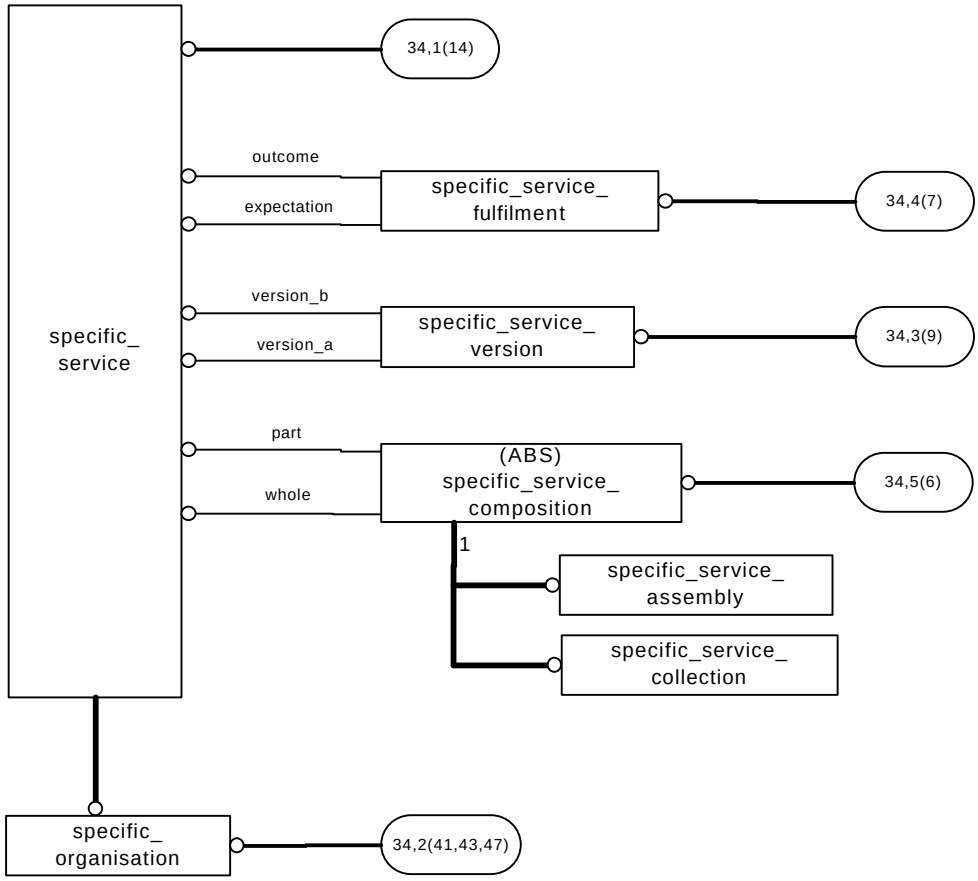

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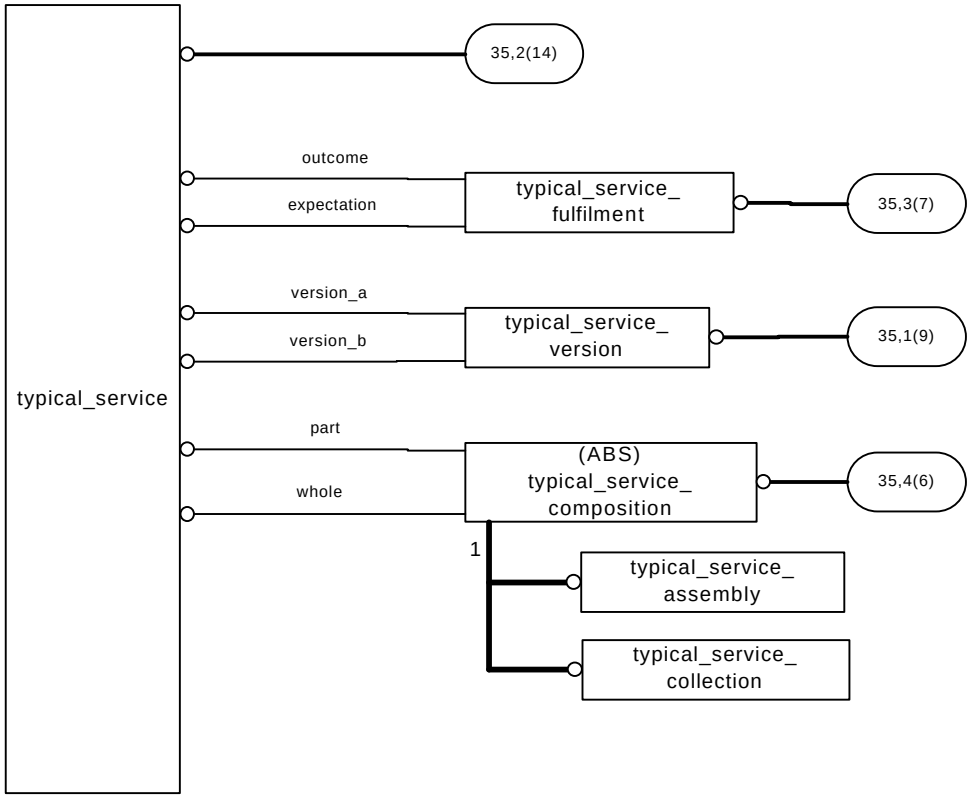

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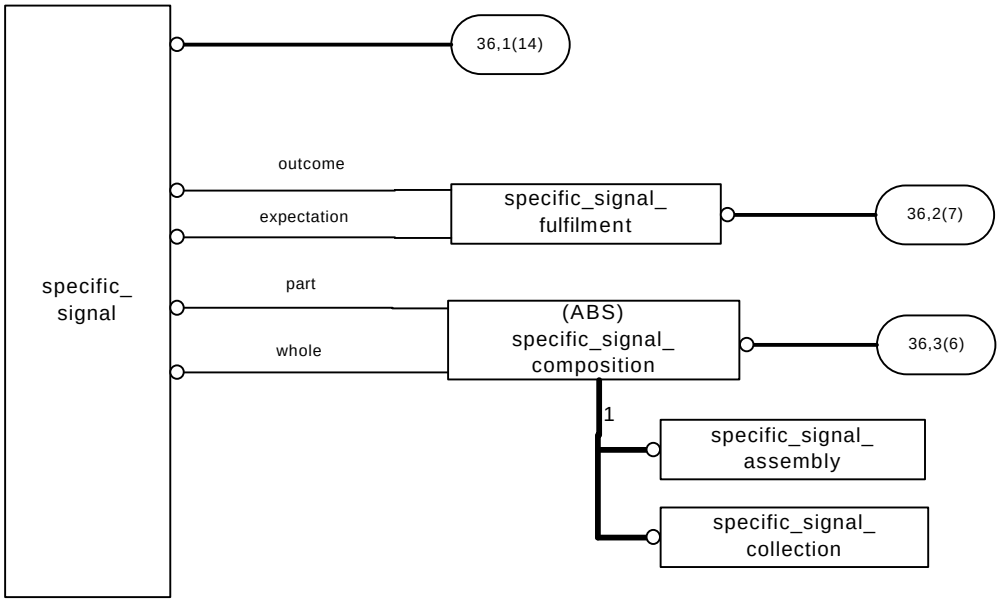

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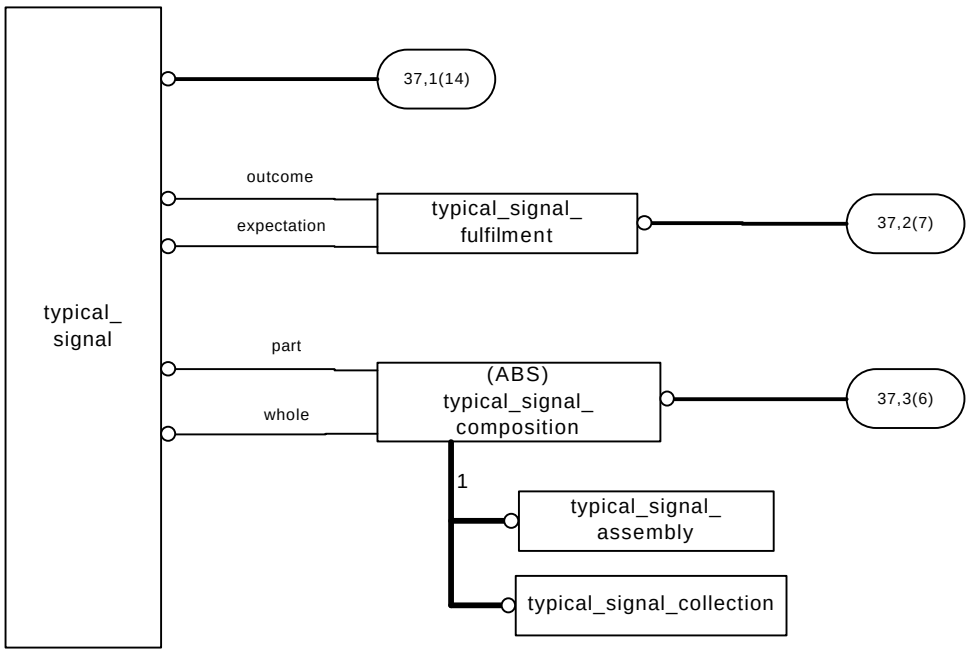

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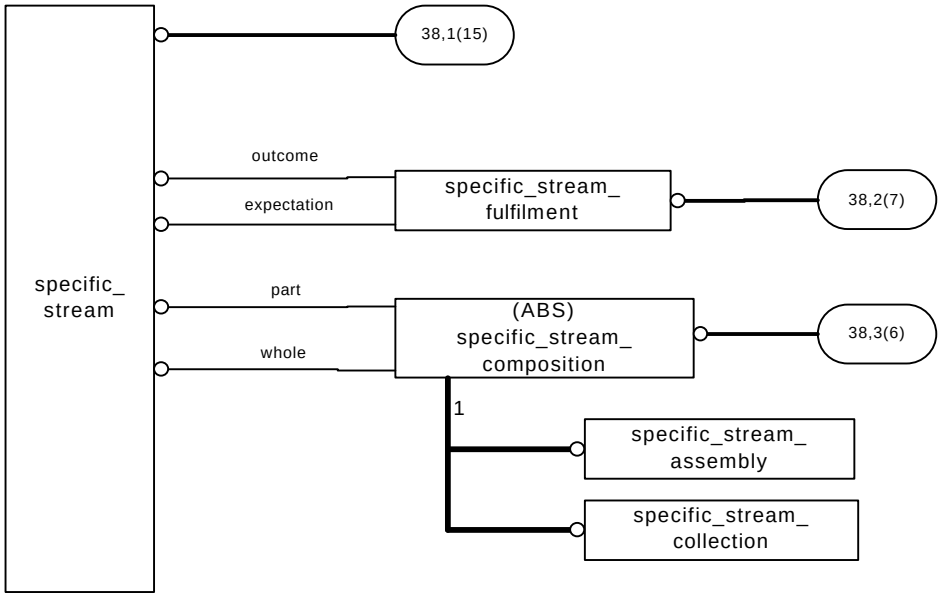

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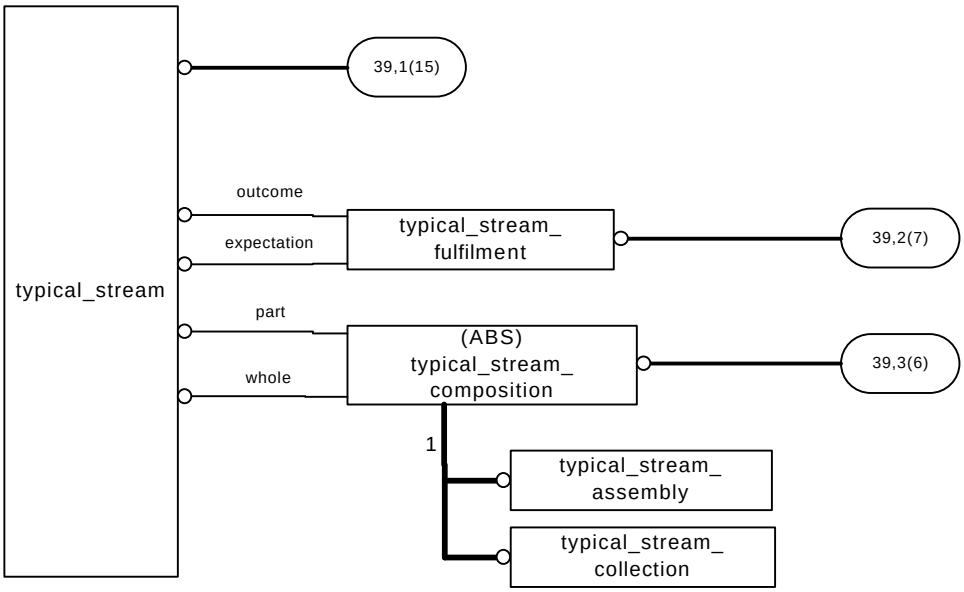

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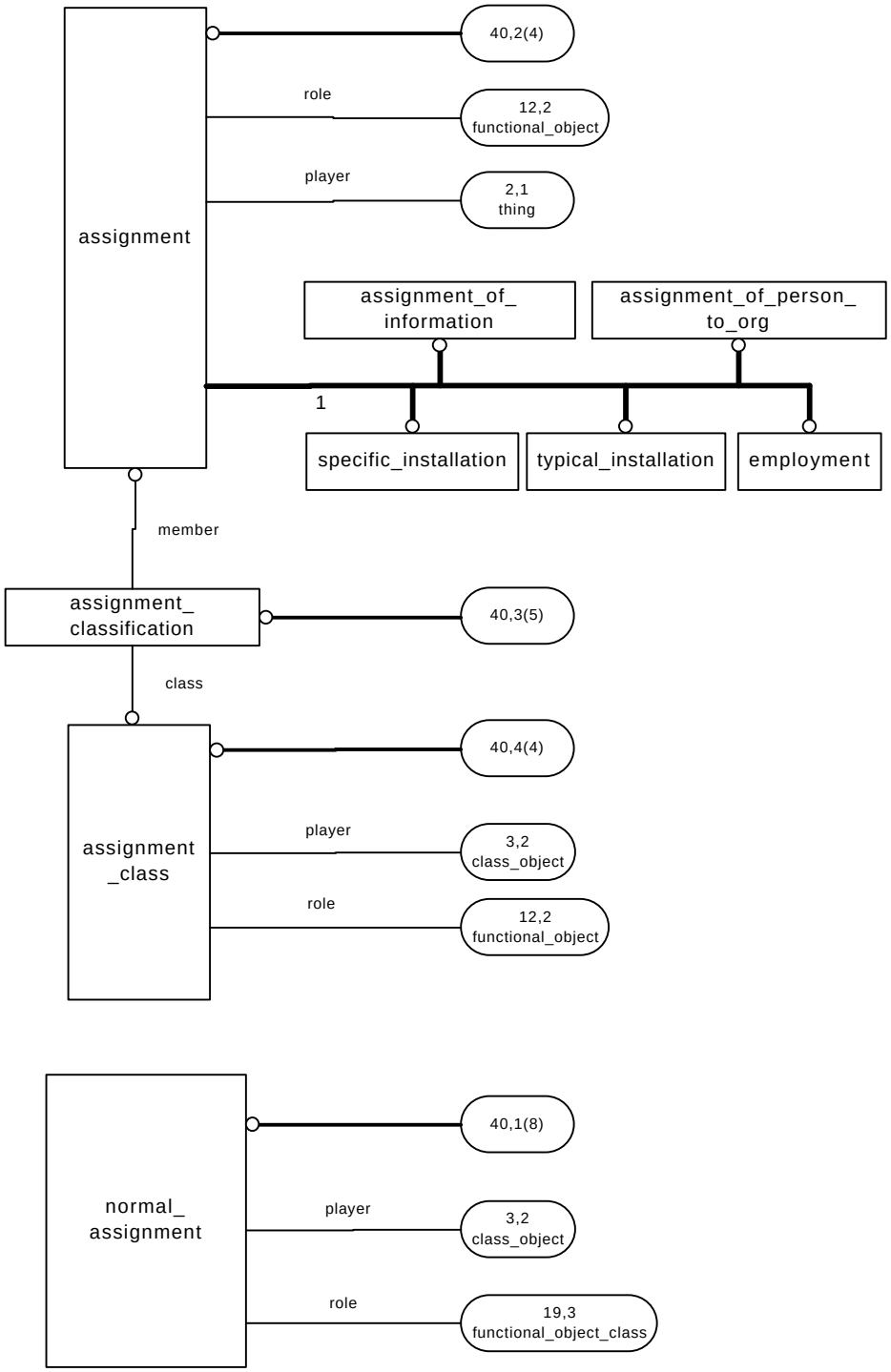

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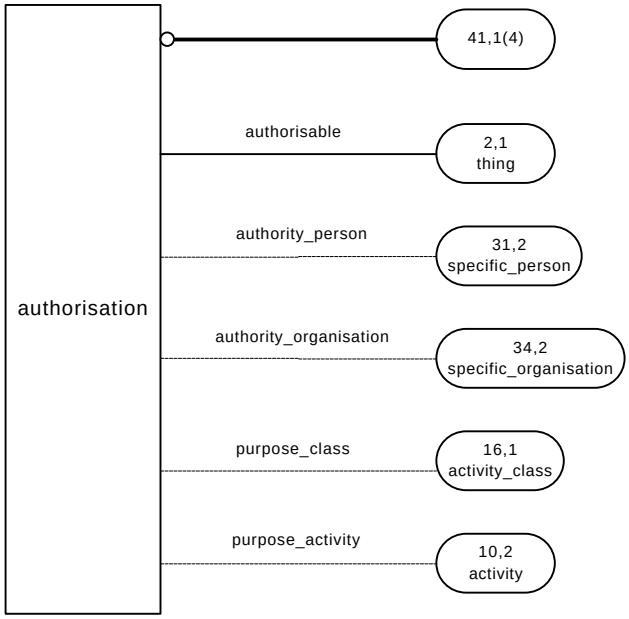

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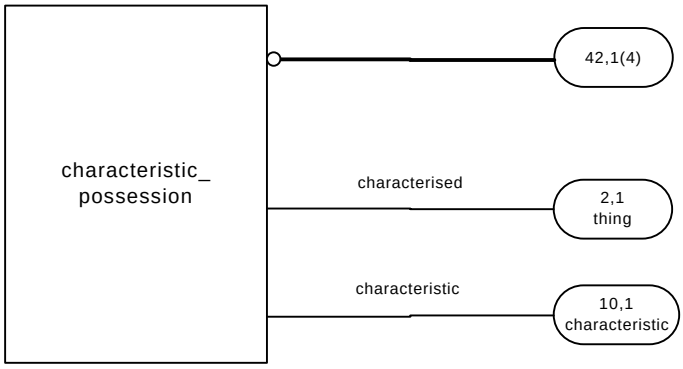

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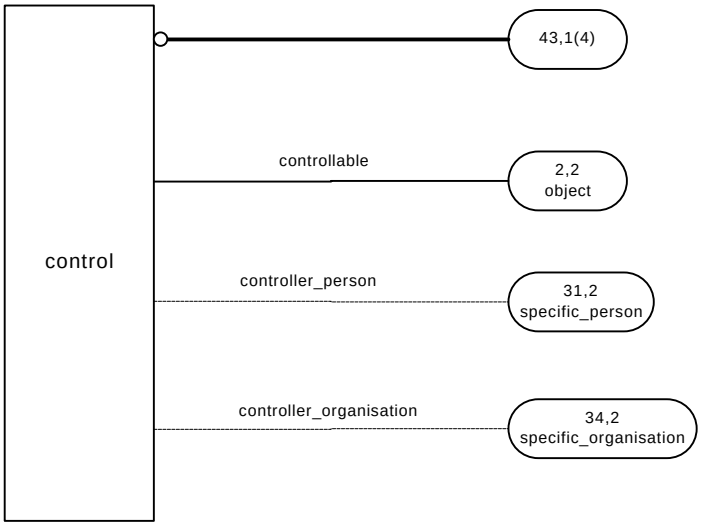

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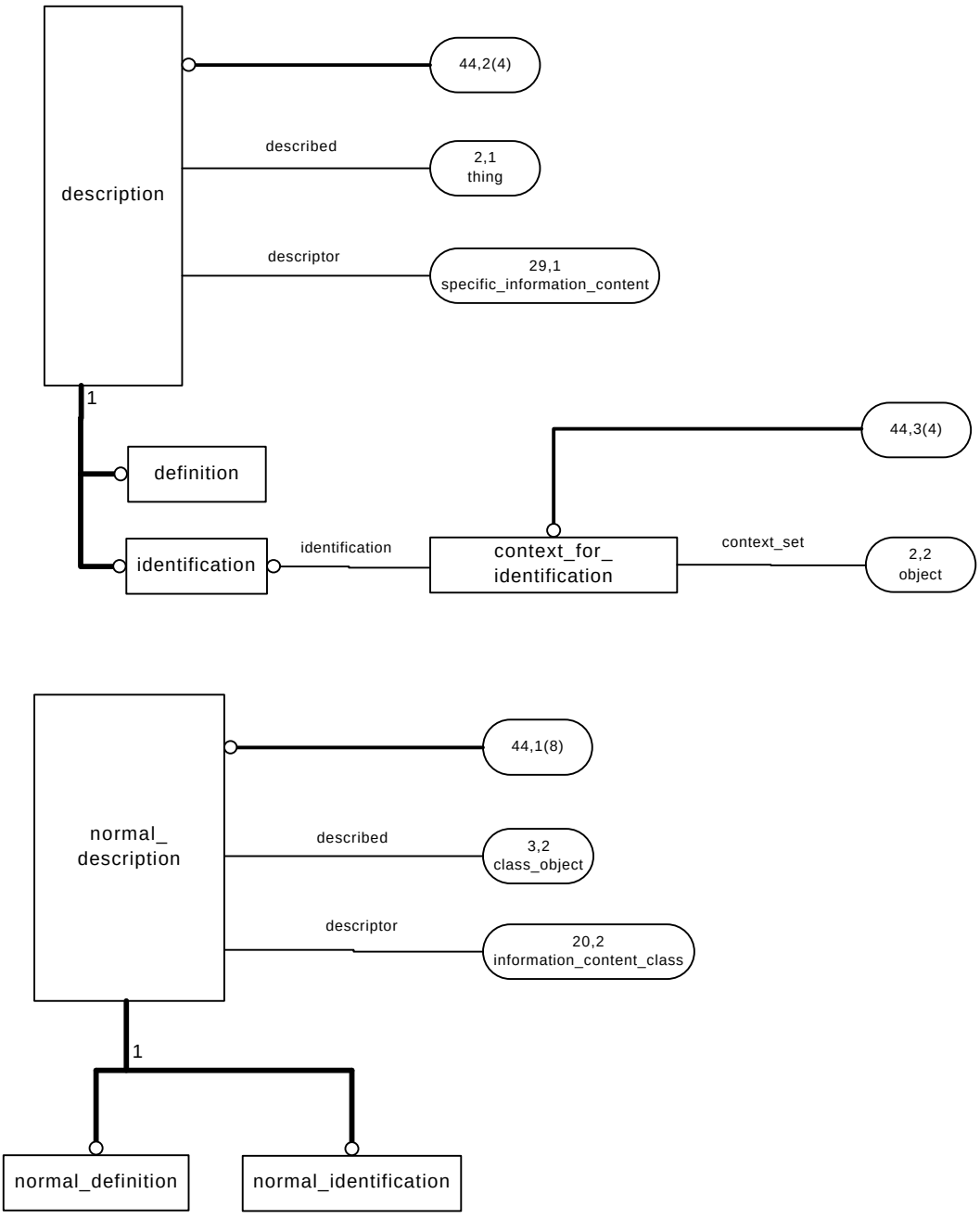

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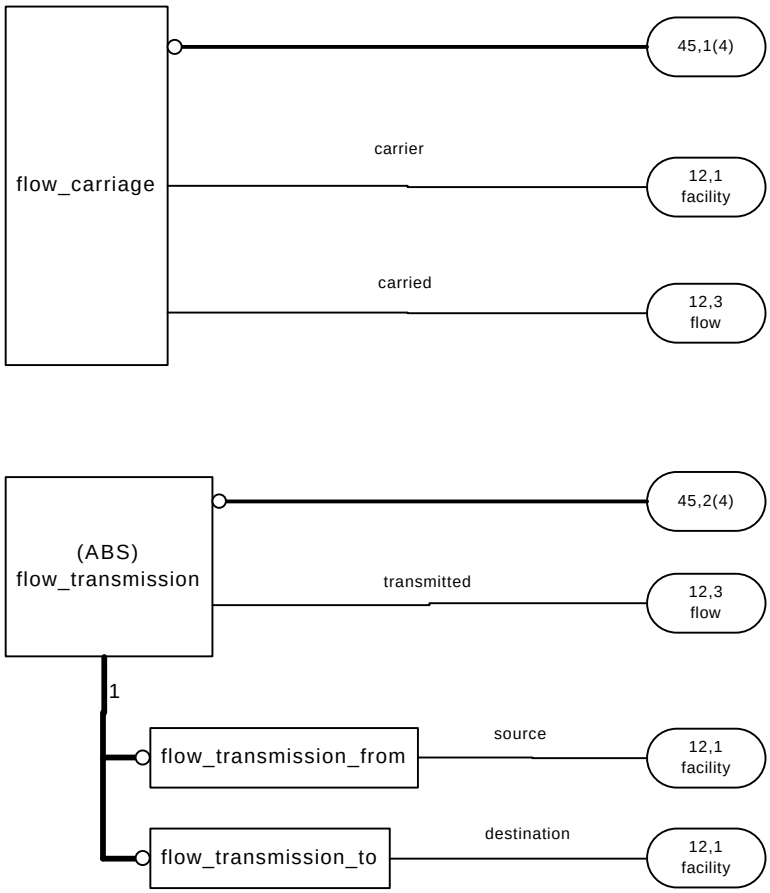

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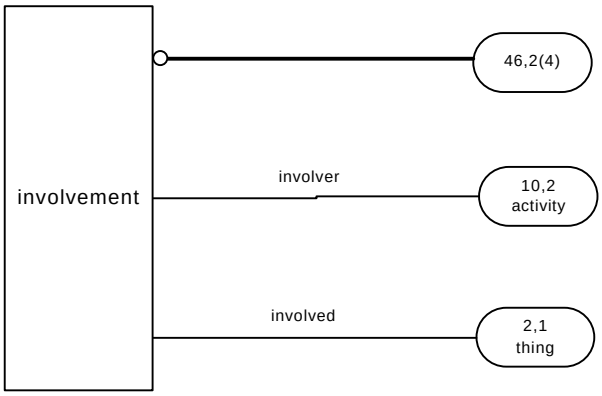

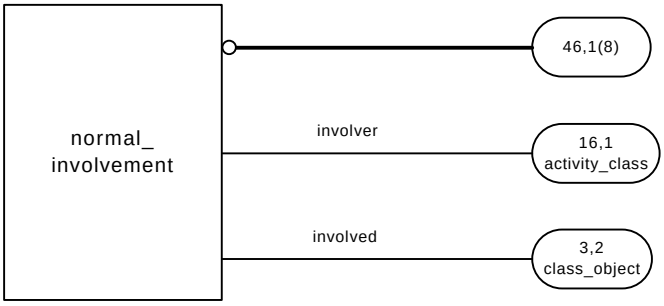

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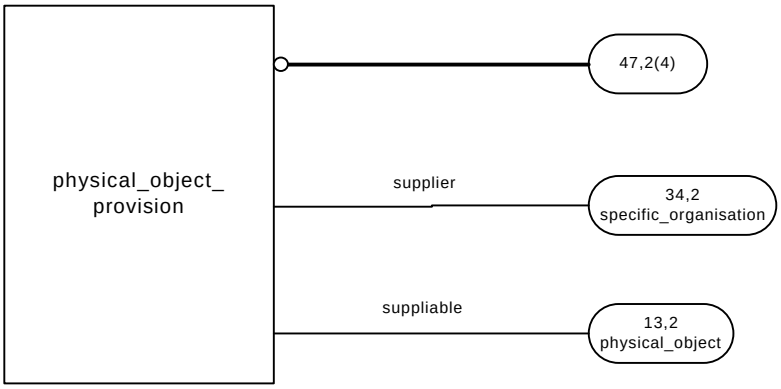

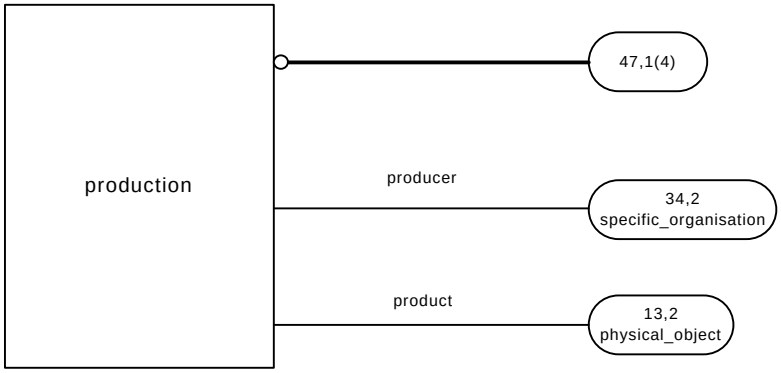

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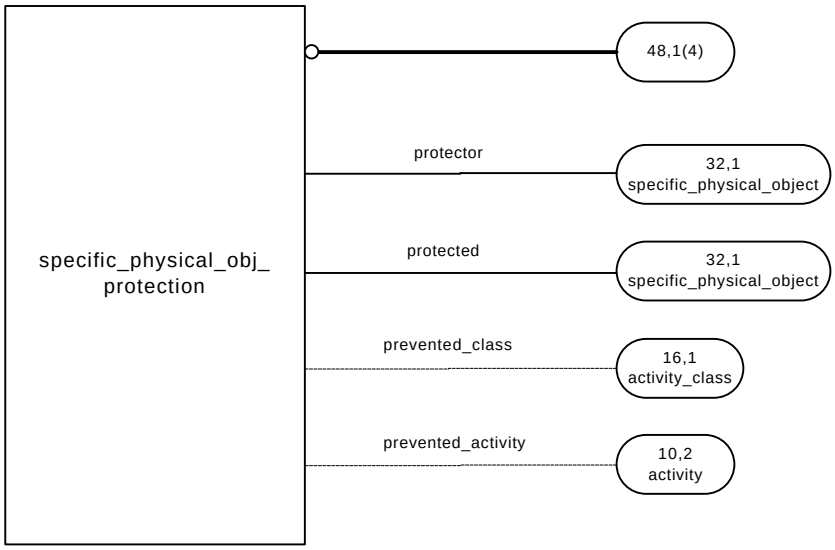

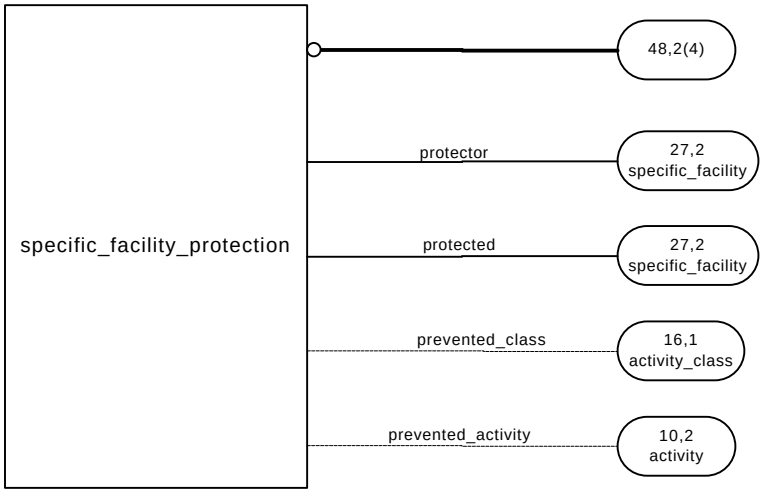

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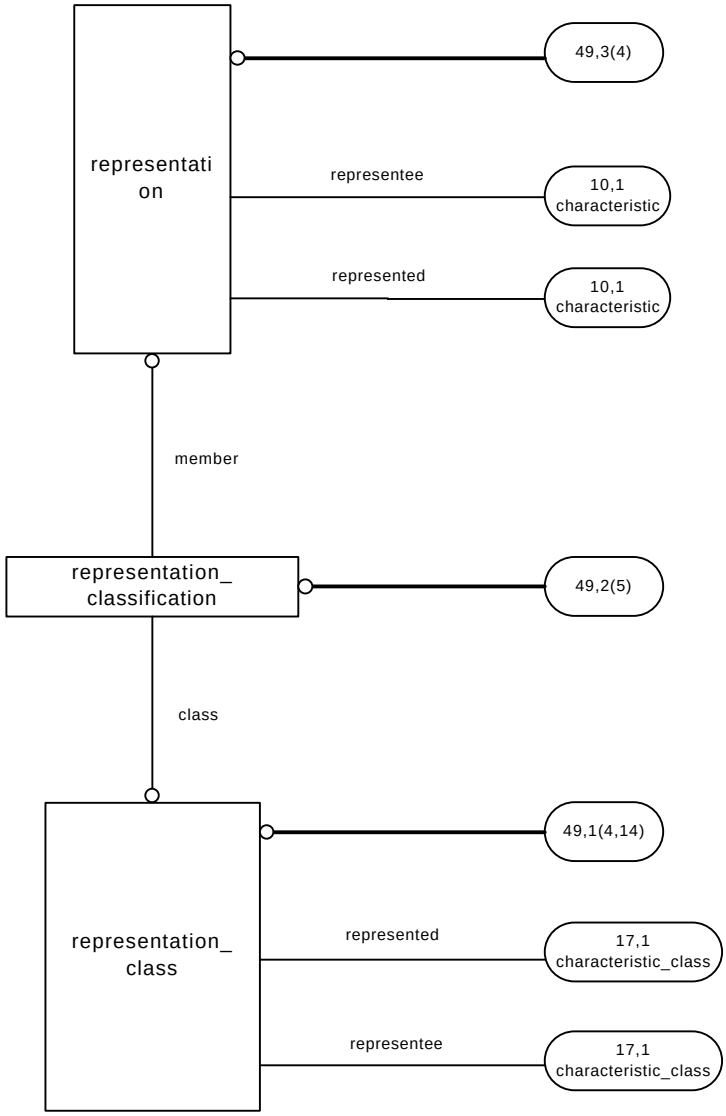

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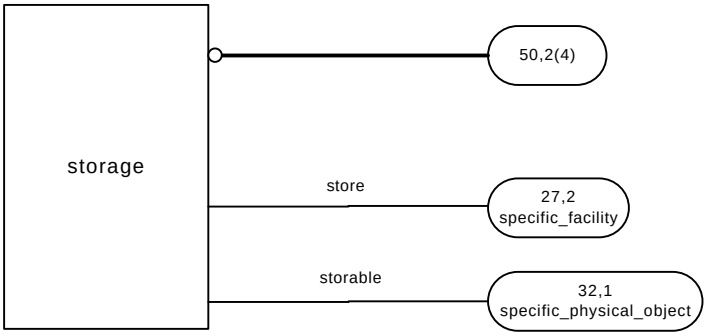

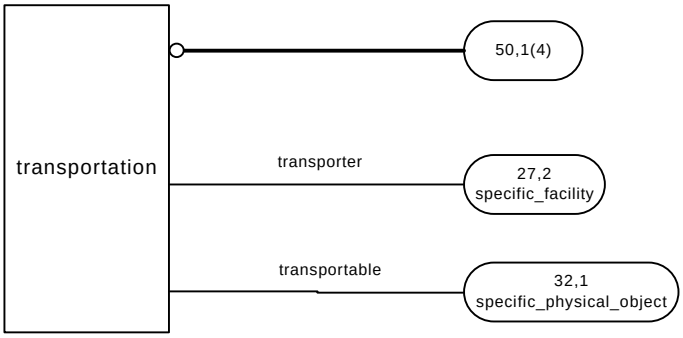

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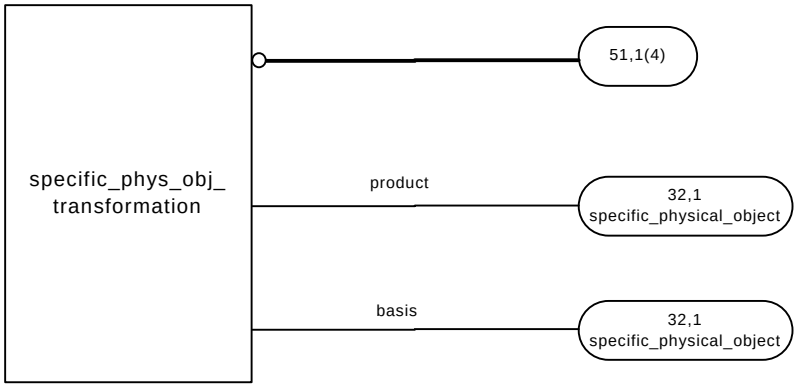


Complete entity level diagram of the oil_and_gas_production_facilities schema Page 51. of 51

Annex C
(Informative)

Data Model Methodology

A set of data modelling principles have been applied to the construction of the data model of this part of ISO 15926. The principles have been designed to result in a data model that meets the requirements of ISO 15926. The requirements and the principles are summarised below.

C1 Model Requirements[1]

C1.1 Data Integration

Integration of facility life cycle data is a primary requirement of the data model. Data integration means combining information derived from several independent sources into one coherent set of data which is what you know. Because the independent sources often have overlapping scopes, combining their data requires the common things to be recognised, duplicate information to be removed, and new information included.

To succeed in the role of integration, the data model must have a context which can include all the possible data that might be wanted or required. Such models are described as conceptual models.

C1.2 Conceptual Model

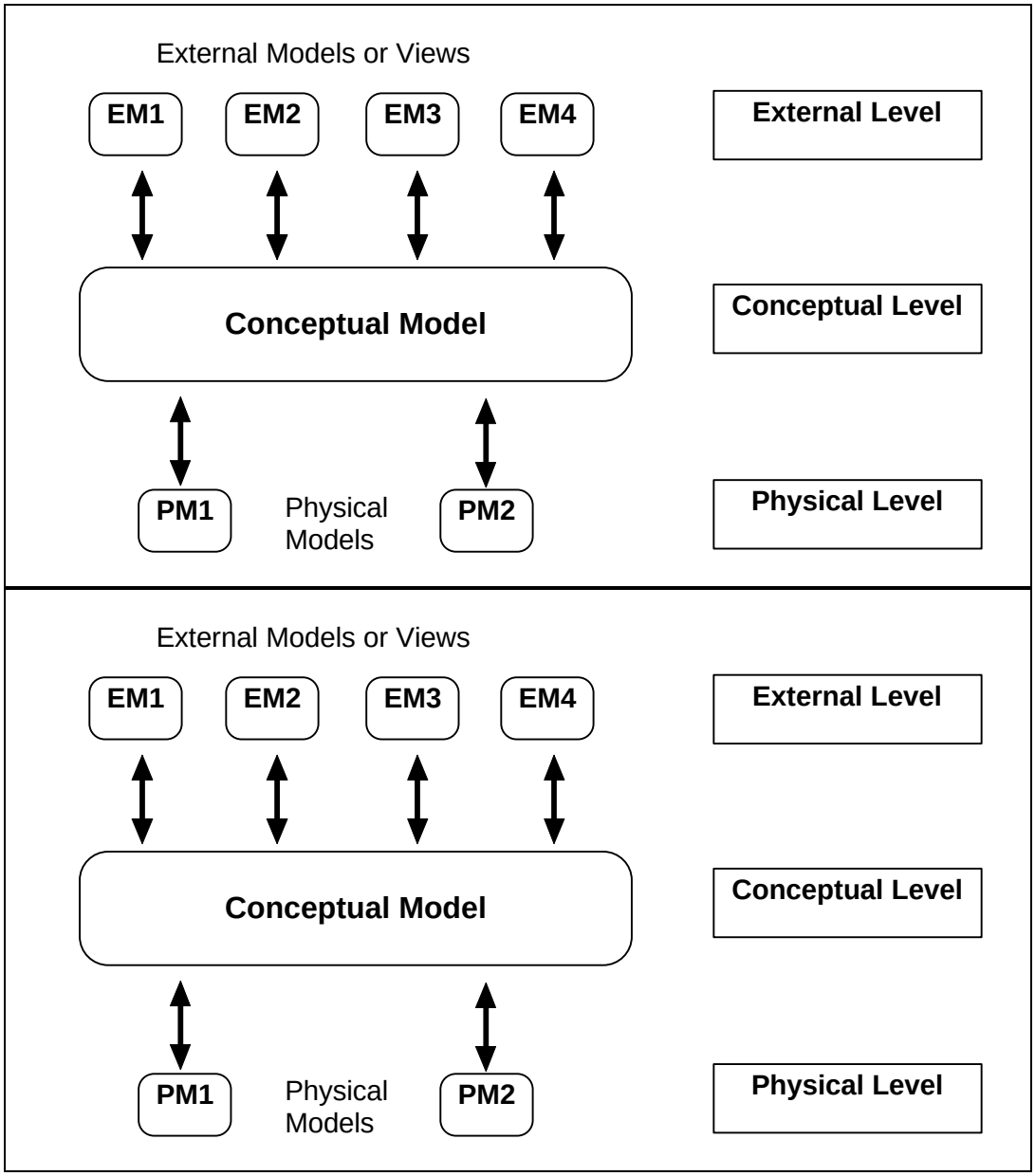
The ANSI SPARC (ref 2).work identified three types of data model use:

- **External model** - the data structure corresponds to a view of data for a particular purpose that includes rules about the data that are appropriate to the particular purpose.
- **Conceptual model** - a neutral model that is capable of supporting any valid view that falls within its scope. Such models can only include rules for data that are universally true across its entire scope for the envisaged life of the model. As a consequence most rules or constraints arising from particular business uses of data are excluded from conceptual models.
- **Physical model** - a definition of the way data is stored. The entities will reflect things that are important for storage and access and not the business meaning of the data. For example, record - meaning stored information.

These concepts are illustrated below in Figure C1.

The ISO 15926 data model is a conceptual model in the sense described by ANSI SPARC. The model excludes all business rules that are appropriate only to specific applications to give a stable and flexible model with respect to developing and changing business practices.

[1] **Acknowledgement** Material in this section is based upon ref 1.


External Models or Views
EM1
EM2
EM3
EM4
External Level
Conceptual Model
Conceptual Level
PM1
Physical Models
PM2
Physical Level
External Models or Views
EM1
EM2
EM3
EM4
External Level
Conceptual Model
Conceptual Level
PM1
Physical Models
PM2
Physical Level

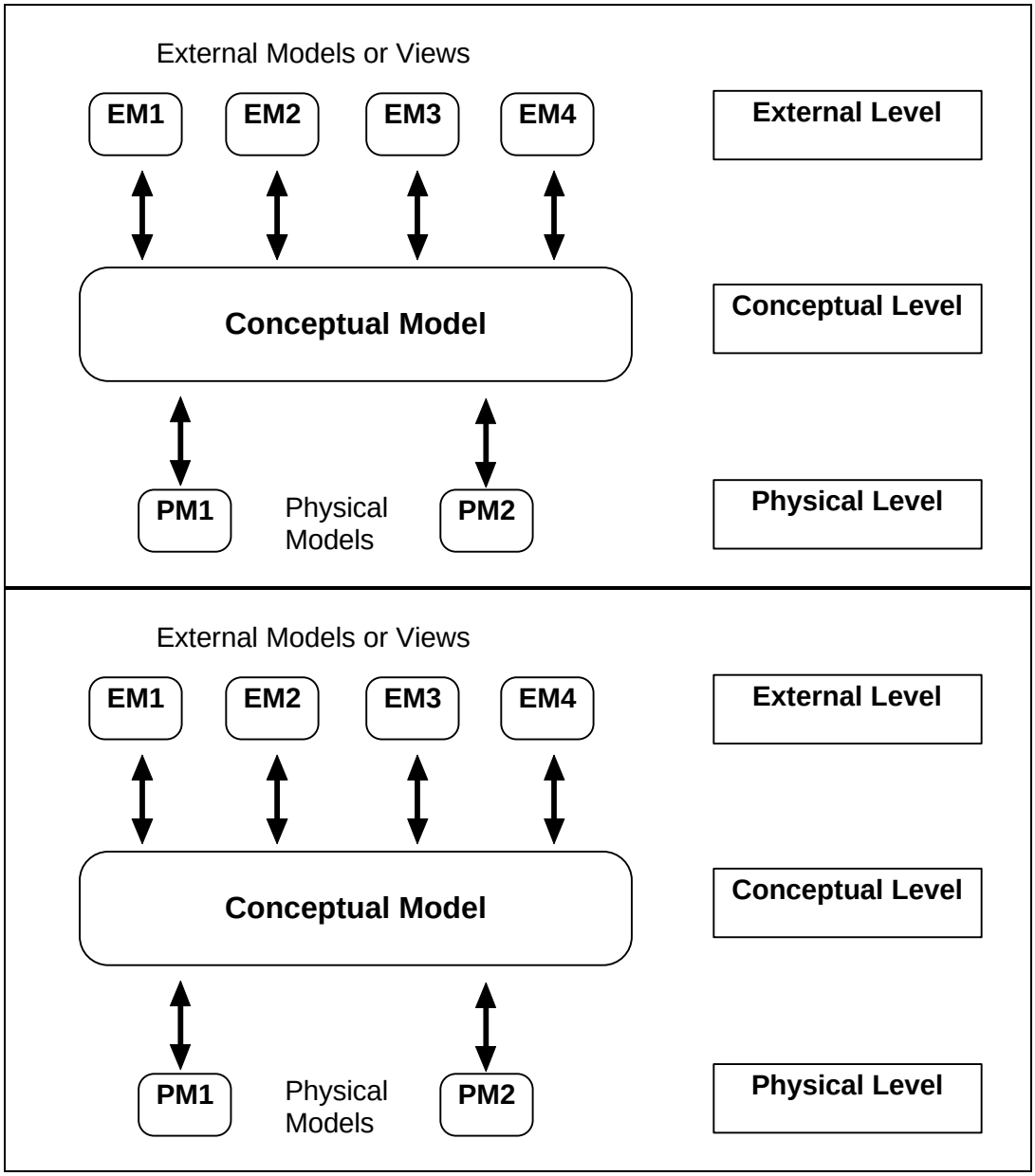


Figure C.1 - ANSI/SPARC three level architecture.

C1.3 Stability and Flexibility

The data model should be able to accommodate changing data requirements within a business scope, so that as people change their mind about the information needed, the data model does not have to be redefined, only its use and the data held by it need change. Hence protecting investments in dependent software systems.

C1.4 Extensibility

The life cycle of oil and gas facilities is a large and complex scope by today's data model practices. The number of areas of specialist knowledge is considerable. A consequence of this is that for any reasonable set of co-ordinated resources, there always will be areas of information that are not covered or need to be covered in more detail. Hence, there is a requirement for the data model to be

extensible, so that it can be developed and refined in a piecewise fashion, adding new areas of information *without the need to change the areas that have already been worked on*.

This is very important because changes to a data model are often very expensive when reflected in systems implementations. Extensibility is a significant factor in minimising information and information system life cycle costs.

The extensibility requirement is illustrated below in Figure C2. Each jig saw piece represents a new area of information being added to an existing model without significant rework of the existing model pieces.

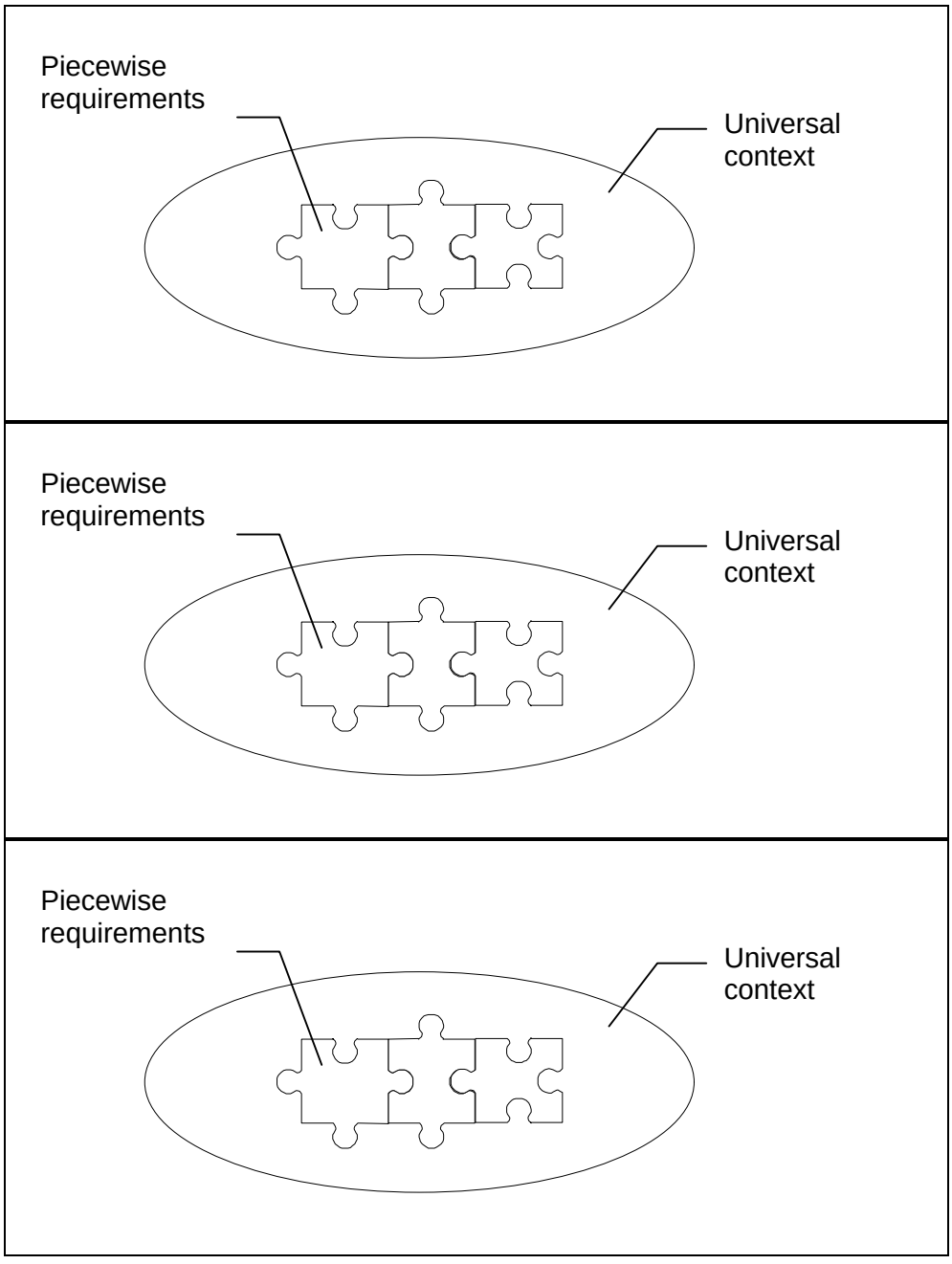


Figure C.2 - Piecewise extensibility of a conceptual data model

C1.5 Consistency

Because much of the data to be integrated will be defined or available using existing systems, it is important that the data model be consistent with other models in common use for facility life cycle data.

Here, consistency means the ease in which data held in one model can be expressed in terms of another model. Clearly to have any consistency, the context of the receiving model must contain the context of the source model. Consistency is further improved if the concepts and model design principles employed in the two models are similar.

Consistency can be formalised using data model mappings. These define what populations of a data model shall result from populations of another data model. The greater the consistency of the two data models, the less complex the mappings.

Several non proprietary models are available with scopes that include oil and gas facility life cycle data, and the ISO 15926 model seeks consistency with all or parts of these models.

- The POSC EPICENTRE data model, this focuses on geoscience data and covers some aspects of production equipment and facilities.

- The process industry STEP application protocols

  - AP221, Process plant functional schematic data

  - AP227, Process plant layout

  - AP231, Process simulation

C2 Data Model Design Principles

The requirements set for the data model can be achieved by using appropriate design techniques. Recognition of appropriate designs for data models have led to the EPISTLE[2] design principles for conceptual models, defined in the EPISTLE Framework (ref 3.)

The ISO 15926 data model is designed in accordance with the EPISTLE principles. These control the use of entities, attributes and relationships within the model. The objective of the principles is to produce flexible, generic data models that minimise the life cycle costs of systems in the face of changing business practices and requirements.

The rational of the principles is described in Developing High Quality Data Models, see ref 1.

By applying these principles, it is important to recognise that the outcome is a *conceptual data model,* representing the underlying (and hopefully unchanging) nature of the things that we are concerned with, supporting any valid *external information view*. Business rules are excluded, as these are liable to change and would require any model that includes them to be changed, which in turn requires any system implementations to change.

There are six EPISTLE Framework principles:

- Attribute domains should in most cases be defined as entity types. This enables information to be refered to and is a major contributor to stability and flexibility. Data models conforming to this principle have relatively few simple data type attributes.

[2] EPISTLE - European Process Industries STEP Technical Liaison Executive.

- Entities should have an internal identifier within a database or exchange file. It should be artificial and managed to be unique. The internal identifier is the system surrogate for the real world object the instance represents.

  The internal identifier is separate from any external identifiers. External identifiers are things such as names, serial numbers used externally to any data base (i.e. in the real world). A thing may have many external identifiers. These data are part of the data model requirement and handled accordingly.

- Activities and associations should be represented by entities (not by relationships or attributes).

  This enables information to be maintained about the involvements of two or more things, including the existence and circumstances of each episode (history).

- Relationships (in the entity/relationship sense) should only be used to express the involvement of entities with activities or associations.

- Entities should represent, and be named after, the underlying nature of an object, not the role it plays in a particular context, so avoiding the duplication of the same object when found in different contexts. Such entities are called *generic entities*.

  To illustrate this consider the terms supplier and customer, often defined as data model entities. These are not generic entities because the terms identify different roles an organisation might play. An organisation may be both a supplier and a customer with respect to some other organisation. Organisation is the generic entity.

- Entities should be part of a supertype/subtype hierarchy of generic entities in order to define a universal context for the model, and avoiding duplication of concepts.

  The EPISTLE generic entity framework (ref 3.) provides this hierarchy. Use of a universal context enables data classified in one model to be rapidly integrated with data from another model located in the same framework.

Annex D
(Informative)

Usage Examples

Insert examples from Snapshot E. Not ready until mid February

Bibliography

1. “*Developing High Quality Data Models* Version 2.0 Issue 2.1” written by Matthew West of the Shell International Petroleum Company Limited, edited by Julian Fowler of PDT Solutions Ltd for EPISTLE.

2. American National Standards Institute Standards Planning and Requirements Committee, Computers and Information Processing (ANSI/X3), 1975.

3. “*EPISTLE Framework V2.0* Issue 1.02”, written and published by Chis Angus for EPISTLE.

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